

BIOCULTURAL CORRELATES OF CHILD NUTRITION AND GROWTH AND DEVELOPMENT
IN COSTA RICA

BY

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Groups of low ($n=19$) and normal ($n=25$) weight for length children were selected from an initial random sample of 107 children from poor neighborhoods in San José, Costa Rica. These children were all born in 1980 and were between the ages of 1 and 2 years at initial measurement. They were then measured monthly for six additional months.

Data were also collected about socioeconomic status, food habits, maternal reproductive history, medical history of the child, and food buying patterns. The Denver Developmental Screening Test (DDST) was administered and a clinical assessment of nutritional status was also made. In-home observations of child-rearing activities were made during which time nurturing or mothering behaviors were recorded. No significant differences between the two groups are reported with respect to total income, food costs, household size, environment, children under 6, birth order, or household food frequency. The matrifocal extended family was found to be an effective survival strategy for

poor families. Low weight/length children were breast-fed slightly longer with later introduction of bottle feeding and solid foods and obtained slightly more abnormal or questionable scores on the DDST than normal weight/length children. Families of low weight/length children owned more material goods, spent more money on food, and tended to be less organized in their habits than were families of normal weight/length children. By use of multivariate regression and discriminant function analyses a model was constructed to predict membership in the low or normal weight/length group. Birth weight, the number of children aged 6 years and under, and other variables representing maternal competence and economic managing abilities as well as material style of life were found to be significant predictors of low or normal weight for length status. Mothering or nurturing behaviors were found to be positively associated with height, weight, and growth in the low weight/length group. The maternal factor, which includes adequate prenatal care and nutrition, as well as maternal competence, is suggested to be of great importance in determining whether low income families have normal or low weight/length children.

CHAPTER I
OVERVIEW OF NUTRITION PROBLEMS WORLD-WIDE WITH
A FOCUS ON THE SITUATION IN COSTA RICA

The incidence of undernourished children in the developing world is known to be high. The Commission on International Relations of the National Research Council (1977:63) cites FAO estimates that as many as 30% of preschool-aged children in low-income countries suffer from second- or third-degree malnutrition, and an additional 40-50% have first-degree malnutrition based on weight for age standards such as those set by Gómez (1956). Jelliffe (1968) notes that the children most at risk nutritionally are between the ages of 6 months and 3 years. This observation has also been verified in nutritional surveys conducted in Africa (Khan and Gupta 1979; Omololu 1978), in Asia (Berg 1973; Winikoff 1978) and in Latin America (Horne et al., 1977; Mönckeberg 1976; Schrimshaw and Béhar 1976). At this age breast-feeding no longer meets the child's needs. Weaning usually takes place during this time; the diet of adults is not adequate for the child; and the infant is more vulnerable to infections (Jelliffe 1968). Malnutrition may occur during or immediately after episodes of infectious disease, even though the child may have been in a state of adequate nutrition before and growing at a normal rate (Mata 1978b). Field studies in India and Guatemala have identified the interaction between malnutrition and infectious disease (Mata 1977; Wyon and Gordon 1971). Mortality in nearly all types of infectious disease is greater in nations with prevalent malnutrition

because of a decreased ability among debilitated or malnourished children to fight off illness (Schrimshaw et al. 1968).

More recently attention is turning to what has been called "invisible malnutrition." According to international health experts, the image of the starving baby is too often used to represent the developing world. Visible and obvious malnutrition occurs relatively rarely, mostly during times of famine and war. Invisible malnutrition, on the other hand, affects about one-fourth of the developing world's children, stealing their energy, lowering their resistance to disease, and thus retarding growth (International Health News 1983:1). Noting that the child's first reaction to the lack of energy intake is to reduce energy output, it is observed that by conserving health and growth at the expense of activity, the child can maintain a normal appearance. Studies have shown that "even children who are regularly eating only three-fourths as much food as they actually need can still maintain weight and growth by cutting out discretionary activity" (International Health News 1983:2). The report further notes that the mutually reinforcing relationship between invisible malnutrition and infection is responsible for the majority of the 40,000 deaths every day among the developing world's infants and children.

Undernutrition of the preschool child has been found to have substantial long-term effects on the subsequent ability of the child to develop, to be educated, and otherwise to function as a useful member of society. Marcondes et al. (1973) found that children with histories of severe malnutrition have poor performances on the Gesell even after being rehabilitated. The Gesell test, developed by Arnold Gesell

and Catherine Amatruda (Knoblock and Pasamanick 1974) is a timetable characterizing infant development during the first years. It includes the categories of physical, gross motor, fine motor, sensory, vocalization, and socialization. Richardson et al. (1972) and Cravioto and Delicardie (1968, 1976) found that children who showed evidence of undernutrition in earlier years were less able to adapt and perform in school. Cravioto and Robles (1963) found the area of hearing and speech to be most retarded in the long run. Yarkin and McLaren (1970), comparing two groups of infants recovering from severe marasmus, found that stimulated children showed greater improvement than did the unstimulated group. Five mental functions comprising the development quotient given with the Griffiths Mental Development Scale were evaluated. These included the areas of locomotor, personal-social, hearing and speech, eye and hand, and performance. Neither group, however, attained the normal quotients by the end of the rehabilitation.

The volume edited by Greene (1977) documents the long-term deleterious effects of malnutrition on the learning capacities and consequent socioeconomic development of whole societies, particular socioeconomic strata (i.e. peasants), and ethnic groups (i.e. Ladinos) throughout the world. Thus, the problem is an important one, the effects of which are potentially very harmful to the well-being of a nation, particularly a developing nation (Aranda-Pastor 1975; Ashworth and Picou 1976; Berlin and Markell 1977; Burgess et al. 1972; Jelliffe 1966; Seth et al. 1979; Villarejos et al. 1971; Wray and Aguirre 1969).

Although the existence of undernourished and malnourished children has been documented in developing countries the world over, and

many important sociocultural variables have been identified, until recently there has been little work done at the household level on the behavioral, attitudinal, and habitat correlates of malnutrition. Most of the work which has been done has taken the form of cross-sectional surveys rather than longitudinal in-home observations. Surveys, however, often do not uncover the causal chain of events leading to consumption-related malnutrition.

Causal Factors Related to Malnutrition

Nutrition workers generally agree that malnutrition in developing countries is the result of many interrelated factors including low income and underemployment, ignorance, poor sanitation, lack of access to medical facilities, family instability (Beghin et al. 1979), changing women's roles in relation to urbanization and participation in the work force (Popkin 1980a; Uyanga 1980), and family structure (size, birth-spacing, one-parent families, etc.).

Taylor and Taylor (1976) constructed a model which, according to them, shows the interrelationships of factors that cause most of the malnutrition in the world. They group causal factors under three headings: the production of food, its distribution, and its utilization. Under production they include factors related to agricultural labor, distribution of land and technology which affects the level of productivity, thus determining the supply of food available. Under distribution are included economic factors (prices and income); demographic factors (population growth and urbanization); cultural factors (beliefs about food, childcare and feeding, social status); and health and nutrition services (feeding programs, integrated services). Under

utilization are included physiological differences (vulnerable groups, e.g. pregnant women and children; malabsorption, genetic adaptation), level of activity, and infection and parasites. Taylor and Taylor note, however, that while they regard these as being general causes they must be adjusted to local situations. Similar patterns of malnutrition may result from different combinations of causes. Thus, they advocate nutrition surveys which go beyond standardized descriptive data to include information which will permit the development of a local causal profile.

Brown and Brown (1977), in their paper giving guidelines for finding the causes of protein-calorie malnutrition in the community, suggest that adequacy of household food supplies, availability of food supplies (agriculture), food procurement (purchases), and food use and feeding practices are useful categories for evaluating the local situation.

Fleuret and Fleuret (1980:250) suggest the following circumstances leading to what they term "consumption-related malnutrition": (1) Food production is inadequate due to lack of land, labor, capital, or any one of these; (2) food production is adequate but some people cannot afford enough food or the right kinds of food; (3) food production is adequate but cultural factors (e.g. food preferences, intrahousehold distribution) cause unhealthy consumption patterns; (4) both aggregate food production and overall income levels are adequate; beliefs and values are nutritionally neutral, but certain categories of the population are constrained by other social and economic factors to make consumption decisions that are inconsistent with good nutrition. Of these

approaches, the latter seems to be the most useful in terms of developing countries.

Reutlinger and Selowsky concur with this latter set of circumstances, noting that "at the global level malnutrition is the inequitable distribution of world income and not the result of an insufficient supply of food" (1979:21).

Socioeconomic Factors

Keeping in mind general guidelines and models, one can find a number of specific studies which illustrate in detail some of the causal factors included in the general framework already mentioned.

Rawson and Valverde (1976) in San Ramón, Costa Rica, found that access to land, fathers who worked as day laborers, working mothers, physical condition of the house, and the number of children under 6 years of age negatively affected the nutritional status of children. Wray and Aguirre (1969) in Candelaria, Colombia, found that the income of the father, family size, birth spacing, and birth order were related to malnutrition in children.

Increasing urbanization as a result of industrialization and the migration of rural people to the cities in developing countries have contributed to the development of malnutrition. Clark (1980) found urban preschoolers to be smaller and less physically developed than their rural counterparts. Villarejos et al. (1971) found the opposite in Costa Rica where rural children exhibited more retarded growth than did urban children. It seems that the change in environment caused by the move to an urban area combined with existing culturally determined food habits has created problems. In Costa Rica this is evidently

mitigated by the existence of extensive health and social welfare programs.

Specific customs of food consumption may interact with local conditions to produce childhood undernutrition. For example, among the Tongans Clark studied, the adult males began the meal, followed by adult females and younger males, with children eating last. When meat was consumed by the family, this was seldom reflected in the diet of the child. Although this custom was prevalent in the rural situation, in the city it created great problems because food items such as domestic meats were less available. Clark also notes that in rural areas where cash income levels were often lower, food purchases were supplemented by family production of meats, fish, and vegetables. Urban families, while enjoying higher cash incomes, lacked sufficient purchasing power to replicate the food variety and quantity available to rural families. Clark also notes that "bush foods" (wild foods which are hunted or collected) were constantly present in the rural diet and almost totally absent from urban diets. This decrease in variety of foods included in the diet seems especially significant in view of the work of Dewalt et al. (1980) in highland Mexico, which suggests that complex diets contain more of the essential nutrients than do more restricted diets.

In addition to these socioeconomic factors a number of other parameters having biological and social significance have indicated that large families, short interpregnancy intervals, and a large number of preschool children at home are risk factors for malnutrition. MacCorquodale and Rondón de Nova (1977) found that in Santo Domingo

malnourished preschool children were from families averaging 4.7 children, while well nourished children came from families with an average of 4.0 children. In Costa Rica, Rawson (1975) found that a significant risk factor for malnutrition was the presence of more than 2 preschool-age children in a household. In Haiti, Ballweg (1972) reported a greater likelihood of undernutrition associated with large families.

In addition to family size, the sex of the infant may be a correlate of malnutrition. Dorjahn (1976) reported that infant mortality in Sierra Leone was higher for females in both the rural and urban areas and suggested sex differential feeding as a causal factor. Other researchers (Rawson 1975) have noted no sex differences in the frequency of malnourished children.

Changes in Child-Feeding Practices

Another important causal factor in the development of malnutrition is the changing pattern of infant feeding. In developing countries this is particularly important because, as Berg (1973) notes, the move away from traditional breast-feeding places a child in double jeopardy: first because of the loss of a high quality food supply (formulas are frequently mixed incorrectly) and secondly through the increased potential for contact with infection as formulas are mixed with unclean water and placed in dirty bottles. This gives rise to what E. F. P. Jelliffe (1979) calls "comerciogenic" malnutrition.

Popkin et al. (1980) note that examination of worldwide data based on large nationally representative samples suggests that, although there has not been a widespread general decline in the prevalence

of breast-feeding (the percentage of women who ever breast-fed), there has been a decline in the duration of breast-feeding, especially in urban areas of Latin America and the Caribbean.

Changes in Family Structure and Women's Roles

Changes in family structure and women's roles have directly affected child-care and thus child-feeding practices. One of the most significant changes in family structure has been the rise of the one-parent household, primarily with the migration of men or women to urban areas and/or the inability of the man to obtain an adequate job. The presence of only one parent has been found to have a negative effect on a child's nutritional status, primarily because a woman who has a child not supported by its father has little economic security. In Jamaica, Desai et al. (1970) found that presence of both parents, small family size, and birth intervals of at least 24 months were associated with high rates of weight gain in children.

Of primary importance is the entry of women into the work force, particularly in urban areas where work may be in factories and is not generally compatible with child care (as selling goods in a village market may be). Women's work hours and conditions have a great influence on child care. Uyanga (1980) notes that having a job which is compatible with child care is positively associated with breast-feeding behavioral changes. He also notes that in urban areas the presence of other members of the family, e.g. daughters, other nonnuclear family members (aunts, grandmothers, etc.), has a positive impact on child-care time and thus a potentially positive effect on nutritional status.

Reutlinger and Selowsky (1976) have observed that infant malnutrition as a result of absence from the home of lactating mothers participating in the labor force is a case of income redistribution within the family in the face of urbanization. Unless sufficient food is purchased for the infant to compensate for the nutrients lost by reduced breast-feeding, the child suffers a negative income effect. Recent research from India according to Reutlinger and Selowsky suggests that a woman would have to spend 76% of her earnings to provide adequate quantities of formula or milk for a 4-month-old infant. In Kenya this would require 58% of the wage, and in Tanzania 51% (Latham 1979). Latham also points out that, since many tropical countries have rather small dairy industries, most of the manufactured milk formulas are imported, requiring the use of scarce foreign exchange. This also contributes to the dependency of developing countries on foreign capitalist powers and multinational corporations like Nestlé.

Economic Development as a Contributing Factor

It is difficult to demonstrate a relationship between socioeconomic development and nutritional status because of the multifactoral etiology of malnutrition and because it is difficult to isolate the effect a specific program may have had. Commercialization of agriculture, long a favorite goal of third world economic development programs, is recognized as leading to a decline in nutritional status (Fleuret and Fleuret 1980; Gross and Underwood 1971). Commercialization of agriculture usually implies introduction

of capital-intensive technology used for producing cash crops for export, e.g. coffee, soy beans, African palm, bananas, horticultural products. Along with this comes a decline in subsistence production as small farmers become involved as wage laborers on large plantations and agroindustrial plants or in producing cash crops on contracts. Women may be left to bear the burden of the garden, or subsistence farming, responsibilities for which they may be unprepared, as they may lack education or experience with gardening or farming. The result is a decline in both yields and in subsistence farming as a whole. Staples must then be purchased with hard earned cash, which tends to arrive in lump sums rather than being distributed throughout the year. This has the effect of making peasant households less self-sufficient and less able to withstand seasonal variations in the supply of staple foods. The net result is an increased vulnerability to malnutrition. This is especially true since private enterprise is rarely able or willing to provide directly for the reproduction of labor power which would entail paying wages sufficient to enable a worker to support a family and obtain adequate housing and health services (Roberts 1978). Certainly Gross and Underwood's (1971) study of the introduction of sisal agriculture in northeastern Brazil is an excellent example of this process. In this example the introduction of sisal, which employed men in the hard and exhausting labor of harvesting and processing, resulted in such increased energy costs in relation to the low wages that a systematic deprivation of adequate calories to the wives and children of the sisal workers was the result.

In order to maintain physical strength, the male of the household had to eat the lion's share of the available food. Thus in the population studied, the children were exhibiting signs of malnutrition—retarded growth and development. The working poor were essentially subsidizing capitalist private enterprise.

The implication of the preceding discussion is that malnutrition, especially infantile protein-energy malnutrition, has a complex etiology. Solutions based on food and nutrients alone are completely inadequate (Pellet 1977). Expecting malnutrition to disappear with economic development and increased GNP seems unrealistic also, in view of the past record and because evidence indicates that low-economic groups benefit unequally in the process of capitalist-oriented economic development (Cornelius and Trueblood 1975; Roberts 1978).

According to Reutlinger and Selowsky (1979:22), empirical evidence suggests that the caloric intake will increase at approximately half the rate at which per capita income rises. On the basis of these assumptions it would take 30 years before the poorest 20% of the population of these countries could reach an adequate level of caloric intake. In their view the high incidence of malnutrition among children of developing countries is not likely to be reduced as part of the development process. The only effective solution according to them lies either in a more equitable income distribution or in supplying food to the target population at low prices. This view is echoed by Teller et al. (1979:21) who state that in general poor countries will attain an adequate nutritional status only when they can provide most of their people with a "minimum socioeconomic package" (permanent employment, adequate income, social security, housing, etc.).

The Costa Rican Situation

Costa Rica (see Figure 1) is unique in Central America because it has long had a democratic form of government, a social conscience among the upper classes, and a fairly large middle class. The Spanish settlers of Costa Rica, throughout the colonial period, found themselves forced to reside in the country where each family labored to produce its own food (Munroe 1918:140).

As the population grew, the entire Meseta Central became divided into small farms. There were a few wealthy and influential families who had been given special privileges by Spain, but they never occupied the dominant position which the aristocracy of Guatemala and Nicaragua had been able to assume, and the land they held never amounted to more than a small portion of the cultivated area of the colony. In 1848 through a special decree the people were permitted to buy the land they had fenced and were using, a measure which had the effect of greatly increasing the number of landholders (Munro 1918:142-143).

Costa Rica achieved independence from Spain in 1821 when she joined with seven other provinces of Central America to form the United Provinces of Central America, which was later disbanded in 1838 because of internal conflicts. Full national sovereignty was not established until 1848. The period between 1938 and 1902 was largely one of dictatorships succeeding one another through coups. Also, during this period Costa Rica had to defend herself against a Nicaraguan invading force in 1836 and from the troops of the North American adventurer William Walker in Nicaragua in 1853-57 (Fanger 1968).

The radical transformation of Costa Rican geography since its independence can be attributed to the development of two agricultural

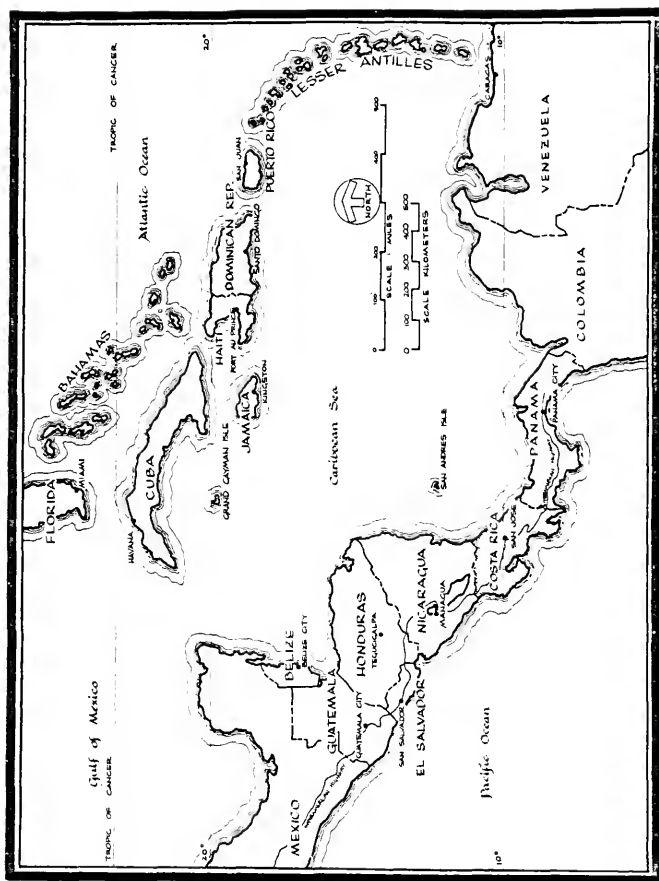


Figure 1. Map of Costa Rica and Central America (Biesanz et al. 1982:2).

products, coffee and bananas (Hall 1976:14). Coffee reached Costa Rica some time before the end of Spanish rule in 1821. A letter from Governor Tomás de Acosta to the king in about 1808 mentions the plant, and by 1829 it was the most important produce of the country. A rush to plant coffee took place in 1841, and the country's economy and thinking became oriented around coffee growing and coffee prices (Lundberg 1976:114). During the 1940s large uncultivated tracts of land owned by the government were sold at low prices or given away as premiums to encourage the planting of coffee. During the last years of the 19th century many persons acquired land this way, and gradually a class of large landholders developed, although the Meseta Central was still composed largely of small farmers (Munro 1918).

The banana has been cultivated since the end of the 19th century in the coastal regions of Costa Rica on great plantations, a system commonly associated with the cultivation of agricultural products for export in many developing countries. These regions have only recently been integrated into the Costa Rican economy and then with great difficulty. Communication and transport were and are major problems. Costa Ricans from the interior (Meseta Central) had little to do with the development of the banana regions. In the Atlantic zone, the north American fruit companies were responsible for developing plantations with labor provided by Negroes from the West Indies (Hall 1976:14).

Although there is at present a small class of large landholders resulting at first from the introduction of coffee and bananas, as noted, and later extending to the Guanacaste area with the introduction of cattle raising for export of beef (Edelman 1983), there has always

existed an egalitarian philosophy on the part of the government and the upper classes. Beginning, particularly in 1948, with the progressive reforms of Calderón Guardia, a series of enlightened social welfare programs have been enacted concerning social security, health, housing, and protection of children. At the present time, Costa Rica, with a population of slightly over 2 million people, has one of the most effective an aggressive health systems in Latin America, encompassing both curative and preventive medicine. An infant mortality rate in 1980 of 19.1 per 1000 population and a life expectancy at birth of 73.4 years (Ministerio de Salud 1982) reflect the general health status of the population. This is comparable to that of the United States in 1970 when the infant mortality rate was 20 per 1000 population. Life expectancy at birth in the United States in 1978 was 73 years. In 1978 the United States had an infant mortality of 12/1000 for whites, 23.1/1000 for blacks, and 21.1/1000 for blacks and other minorities. The infant mortality rate overall was 13.8/1000 (U.S. Dept. of Commerce, Bureau of the Census 1981). Other countries in Central and South America had the following infant mortality rates: El Salvador and Guatemala in 1979, 53 per 1000 and 70.1 per 1000 respectively; Colombia, 39.5 per 1000 in 1977; and Argentina, 40.8 per 1000 in 1978 (Demographic Yearbook—1980, 1982). Mata et al. (1980a, 1981) notes that the diarrhoeal disease death rate was 11 per 100,000 with about 140 infant deaths per year due to diarrhea. No cases of poliomyelitis or diphtheria have been recorded in recent years and few cases of measles and whooping cough, indicating a favorable national health immunization system.

The health system, as it is currently organized, dates from the early 1970s when the National Plan of Economic and Social Development

was implemented. This plan has as its goal the improvement of the quantity and quality of basic services available to Costa Rican citizens and was begun in rural areas in 1973 and in urban areas in 1974. In relation to health care, these basic services involve the cooperation of the Ministry of Health, the Costa Rican Social Security Administration, the Costa Rican Institute of Aqueducts and Sewers, and the National Insurance Institute. The goals of the program are as follows:

1. To extend basic health services to poor rural and urban communities using health auxiliary workers.
2. To control and reduce infectious diseases through immunization programs.
3. Referral of patients to either preventive or curative facilities, depending on medical diagnosis.
4. Planned visits to homes and businesses to evaluate health needs.
5. Emphasis on environmental health, health education, and community organization. (Freer Miranda 1980)

In 1966 a national nutrition survey was conducted in Costa Rica by the Instituto de Nutrición de Centro América y Panamá—INCAP (1969). Rawson (1975), Rawson and Valverde (1976), and Valverde et al. (1975) investigated the nutritional status of preschool children in the community of Concepción de San Ramón, Costa Rica. In general these studies indicated nutritional deficiencies in preschool children which were moderate but chronic. Deficiencies were more pronounced in low socioeconomic groups. According to the INCAP study (INCAP 1969), the four types of malnutrition which most frequently occur in Costa Rica

are protein-energy malnutrition (PEM), nutritional anemias, vitamin A deficiency, and goiter (iodine deficiency). Mata (1979), however, notes that of these four the single most important deficiency is that of protein-energy malnutrition, or PEM. It is the most common and has the most complex etiology which makes its study and control more difficult.

Results of the San Ramón study, in which the Gómez scale (Gómez et al. 1956) was used, revealed that 38.9% of 149 children aged 0-5 years were of normal weight, whereas 46.3% exhibited first degree malnutrition, 13.4% second degree malnutrition, and 1.3% third degree malnutrition. Therefore, more than half of the children (61%) were found to be below the normal weight range. Fifteen percent were in the lowest two groups (below 75% of normal weight). Contrary to findings already cited for other areas, the effects of malnutrition in San Ramón apparently become worse as the children grow older. This pattern of chronic rather than acute malnutrition in neonates and preschool-age children points to factors or interrelationships of causal factors different from those found in other developing countries.

Rawson (1975) and Rawson and Valverde (1976) note a number of socioeconomic and cultural variables associated with nutritional status. Variables significantly ($p \leq 0.02$) associated with childhood malnutrition were access to less than 1.4 hectares of land, more than one sibling under 6 years of age, father works as a day laborer, mother works outside the home, house in poor physical condition, poor stove quality, and little access to fresh milk. Variables not significantly associated with childhood nutritional status included education level of the parents, type of

family unit (nuclear, extended, or single parent), sex of the child, age at weaning, and salary income.

A more recent National Nutrition Survey (Ministerio de Salud 1978) also noted relationships between house conditions and nutritional status. Poor housing conditions were associated with poor nutritional status among preschool children (Table 1). The condition of the house was assessed on type of house construction, number of rooms, presence and condition of bathrooms and toilets, water supply, presence and condition of windows, quality of cooking facilities, etc.

Table 1 indicates that the highest prevalence of malnutrition (Gómez's first, second, and third degree combined) in children aged 0-5 years occurs among children in poor housing in the urban areas—63.1% compared to 51.3% in the dispersed rural areas and 55.5% in concentrated rural areas. The overall national percentage of children and infants in poor housing with first degree malnutrition is 45.1%. As housing conditions improve, the proportion of children underweight for age decreases markedly.

Some studies have suggested that malnutrition in Costa Rica is frequently the result of factors other than lack of food, such as passive child abuse manifested as neglect. Stunting and wasting were found to be much higher among abused children (Mata et al. 1980b). Mata, in another paper (1980), cites decreased maternal competence, failure of bonding, and infections as factors which are just as important as available food in the development of PEM.

Salazar and Cervantes (1979), in a preliminary report based on the national survey, also note positive relationships between education of the

Table 1. National Distribution of Children 0-5 Years by Weight for Age According to Condition of Housing and Degree of Urbanization

Condition of housing	Weight for age			
	Overweight	Normal	First degree	Second and third degree ^a
	----- % -----			
National	11.4	42.7	37.3	8.6
Good	14.2	47.7	31.6	6.5
Fair	13.0	44.5	36.2	6.3
Poor	5.6	34.2	45.1	15.1
Urban	14.0	43.0	37.0	6.0
Good	18.5	46.8	30.8	3.9
Fair	13.8	46.0	36.9	3.3
Poor	6.0	30.9	49.1	14.0
Concentrated rural	11.6	43.6	36.0	8.8
Good	11.6	49.7	29.5	9.2
Fair	13.5	42.8	36.3	7.4
Poor	7.7	36.8	43.5	12.0
Dispersed rural	7.7	40.8	39.5	12.0
Good	8.4	44.5	40.0	7.1
Fair	11.5	46.2	34.9	7.4
Poor	3.8	34.4	43.7	18.1

Source: National Nutrition Survey (Ministerio de Salud 1978).

^aGómez (1956) classification.

head of the family and spouse and nutritional status of preschool children. In households where the head of the household is illiterate, 57.9% of the children 0-5 years of age are malnourished based on the Gómez scale. As the educational level increases, the proportion of malnourished children decreases: secondary-level education—37% malnourished; university-level education—20.2% malnourished.

The 1978 survey also revealed a downward trend in the incidence of breast-feeding. Thirty-seven percent of infants in rural areas were weaned in the first month of life, often at birth, and by 5-6 months approximately 60% had been weaned to formula milks. Also, infants who were breast-fed frequently received supplements; only 19% were exclusively breast-fed at 4 months of age. In response to this problem Dr. Leonardo Mata and his team of workers from the National Institute for Health Research (INISA) have begun an innovative and very interesting nutrition-related project. The primary site of this work is the area of Puriscal, primarily involving dispersed and concentrated rural settlements. The Puriscal study was begun in September 1980 in conjunction with an intervention aimed at increasing breast-feeding. All the mothers in this area are included through the prenatal clinics. Eighty-four percent of deliveries are in the San Juan de Dios Hospital, 13% in maternities and clinics of San José, and 3 percent in the home. The objective of the project is to increase breast-feeding by increasing the opportunities for maternal/infant bonding in the hospital situation after birth. Attempts were made to change hospital policy to foster rooming-in to some degree. A milk bank was created to provide milk and colostrum for high-risk neonates. The project includes in-home surveillance as well as the hospital stimulation. The result has been a

dramatic increase in the incidence of breast-feeding in the study population (Mata et al. 1981).

Another program of great interest is that of the canasta basica alimentaria, or basic food basket program. This has been in the process of development since the survey of 1966. A basic diet was elaborated which as of 1981 included 12 basic food items considered necessary for an adequate diet (see Table 2). This list is used to determine the impact of cost-of-living increases and also to plan national food production with the aim of ensuring adequate supplies of these items. Another objective of the basic food basket concept is to control prices so that these items remain within the reach of the poor (Murillo et al. 1981). Until 1982 most of the items on this list were subject to controlled prices. At that time, inflation forced prices to be raised. The concept is still very useful, however, because it tends to focus national attention on the basic requirements for maintaining good nutrition for all population groups.

Costa Rica also has a nutrition rehabilitation center housed in the facilities of the Costa Rican Institute of Investigation and Teaching in Nutrition and Health (INCIENSA) located in Tres Rfos. In addition to ongoing research projects, this institution is a referral center for severely undernourished children (3rd degree by Gómez standards). These children come from all over Costa Rica. Their numbers are relatively small, however, because of the ongoing surveillance program conducted by the community health workers.

As part of the national nutrition surveillance program, the System of Nutrition Information (SIN) was set up to utilize the data which are

Table 2. Structure of the Basic Costa Rican Food Basket in Grams per Person per Day (average for the country)

Food	Quantity (grams)	Calories	Percent of total calories
Milk (liquid)	445	289	9.95
Eggs	31	46	1.60
Meats	84	206	7.10
Beans	74	255	8.80
Vegetables	105	34	1.17
Fruits	44	17	0.60
Bananas and plantains	49	56	1.95
Roots and tubers	69	78	2.70
Rice	187	682	23.50
Wheat bread	78	218	7.50
Tortilla	68	136	4.70
Sugar	102	377	13.00
Vegetable shortening	51	447	15.40
Ground coffee	13	29	1.00
Soft drinks	96	30	1.05
Total	1496	2900	100.00

Source: Murillo and Mata (1980:101-104).

constantly being collected locally by health workers to define and describe target groups of households at risk for undernutrition on a national level. The goal of SIN has been to develop a functional classification which involves describing categories of poor families and relating the prevalence of malnutrition with relevant specific social, economic, and cultural factors. A functional group is defined as a set of families sharing a similar pattern of living, that is, the same type of production, the same type of social and economic constraints and access to existing resources, and similar cultural practices (Valverde et al. 1981).

Thus, while nutrition problems exist in Costa Rica, a number of very effective and sophisticated programs exist for the purpose of evaluation and surveillance of nutritional status. Nutrition problems in Costa Rica, while not severe, are complex, requiring subtle and innovative ways of measuring the extent of the problem and evaluating the progress already made. Subsequent chapters will deal in more depth with the statement of the problem and methods used in looking at the status of child nutrition among the urban poor in San José.

CHAPTER II STATEMENT OF THE PROBLEM

The major purpose of this research was to define biocultural causal factors in undernutrition and retarded growth and development in a sample of infants aged 12 to 24 months in the poor urban barrios of San José, Costa Rica. A holistic anthropological approach was used to elucidate the diverse strategies employed at the household level which lead to well or poorly nourished children.

Undernutrition is most prevalent among poor people; yet, among the poor there are those who maintain good or excellent health and nutritional status. The underlying hypothesis of this research is that strategies of resource accrual and dispersion as well as absolute levels of nonshelter-related real income within a household are significant factors in the determination of nutritional status. It was anticipated that below a certain level of income, the proportion of undernourished children would increase dramatically with relatively small decreases in real income. The object of the research was to do in-depth, cross-household evaluation of resource utilization in poor households, comparing those with well nourished children to those with undernourished children.

Nutritionally related high-risk factors and strategies have been identified for rural populations (Desai et al. 1970; Rawson and Valverde 1976). These factors tend to be related to ownership and access to farm lands. In the urban context, however, little work has been done to

elucidate those factors which contribute to well or poorly nourished children. The urban populations are of special concern because as migration continues from rural to urban areas, the increased population size puts pressure on the economic system to provide more jobs and wage-related income for recent migrants. These migrants, usually young and within the growth phase of family development, are suddenly confronted with new economic and environmental stressors which require the development of new resource-related strategies and the development of new skills to enhance their wage-earning abilities. As a result, the more resourceful have developed coping mechanisms which enable them to survive on very little, primarily within the informal economy or small-scale sector, e.g. lottery ticket sellers, street vendors (Roberts 1978). This "tertiarization" of the economy—the expansion of employment in the commercial and service sectors rather than in manufacturing—has been associated with urban poverty as an adaptive mechanism allowing migrants to the city to eke out an existence. Peattie (1975) provides an excellent description of how this phenomenon works in a Latin American city. The resourcefulness of the poor is further emphasized by such works as that of Lomnitz (1977) describing mutual reciprocity networks and Arizpe (1980) who investigated relay migration (family members taking turns going to the city to live and work). Both of these works were carried out in Mexico and illustrate very well that if anyone can squeeze better nutrition out of a low income, these people can. One of the objectives of this research was to become more familiar with these strategies as they exist in Costa Rica and to glean knowledge which would be helpful in understanding this complex problem.

In particular, the research focused on strategies of food acquisition and allocation within the household context and on the decision-making associated with these strategies. As noted earlier, malnutrition has a multifactorial etiology; nutritional and health surveys often do not uncover the underlying and/or intervening variables which are the essential links between access to food and the nutritional status of the child. In addition, survey data tend to obscure intracultural diversity which accounts for the observation that among the poor some children are well nourished while others are not. In short, we know that malnutrition exists. We have many supposed causes. We do not understand very well how these causes relate to specific cases at the family and household level. In other words, we do not know much about the target group, particularly in the urban areas where most of the poor are now concentrating in developing countries. It may be that below a certain level of income the only way to improve nutrition is to increase income. Above this income level, however, there is a tremendous gray area which still includes many families in which there are undernourished children. This gray zone may be amenable to many kinds of programs, such as education, food subsidies, etc. The problem occurs when a program is aimed at those people below the crucial economic level but uses methods which are meant for the people in the gray zone. The program may then be evaluated as a failure when very few people in the target group respond to it. Or it may be judged as a success by the number of people participating but yet not reach those who are critically in need of assistance. This research, therefore, was aimed at investigating intracultural diversity at the household level by use of

a variety of research techniques to obtain a clearer picture of causal factors involved in undernutrition of specific groups. This research contributes methods for characterizing children at risk nutritionally which allows more effective targeting of nutrition intervention programs.

Data indicating the importance of family structure to the survival of low income families came from an in-depth multidisciplinary study done in the urban barrios of San José which focused on marijuana use by adult males (Carter et al. 1976). This study contains some information on the nutritional status of adult males. More important for the purposes of this research was the information on family dynamics, kinship-based networks, and the general environment of lower-class neighborhoods. As described by the adult male informants in the study, a typical family of orientation has about five members, including both parents, two or three children, and occasionally a bilateral relative such as a sibling or an aging parent. The range in family size, however, is reported to be wide. A frequent pattern encountered was a periodic doubling up on space within an extended family group to reduce costs during periods of economic stress, which frequently occurs because many children and adults are seasonal laborers. In this study 20% of the marihuana users and 5% of the nonusers came from single parent households headed by the mother. Often surrogate parents, e.g. grandmothers, aunts, or uncles, were child caretakers. In contrast to other areas in Latin America, fictive kinship, godparents, and compadrazgo are relatively unimportant (True 1976:69).

Although the households were found to be largely restricted to the immediate nuclear family, both marihuana users and nonusers were almost

always in constant contact with extended kindred networks. These networks are potentially very important to the nutritional status of the child since they tend to be the source of most surrogate parents and kin may share food, material goods, and money.

Costan Rican anthropologist Eugenia Lopez de Piza (1979:4-5) has described four family types which she had found to be common in Costa Rica: the nuclear family, consisting of father or father substitute, mother, and children; the extended family, consisting of related nuclear families; the matrifocal family centered around the mother and her children; and what she has termed the "Queen Bee" family, which is a variant of the matrifocal type and consists of the grandmother, her daughters, and their children. In this latter family type, the daughters work and the grandmother cares for the children and controls the money. This extended matrifocal family is similar in structure and function to the three-generation family with a female head described by R. T. Smith (1956:106) for British Guiana. It is also similar to the "grandmother families" described by M. G. Smith (1962) for the West Indies. Lopez de Piza (1979:15) calls the matrifocal family in Costa Rica, particularly the "Queen Bee" variant, the best adaptive mechanism enabling poor women to obtain economic necessities and care for and educate children.

Mothering ability or maternal competence is another factor which has been implicated as a risk factor for malnutrition. Mata (1979) in Costa Rica cites deficiencies in maternal technology and social pathology as becoming increasingly important causal factors in child malnutrition in modern times. Alvarez et al. (1977) in Chile found that

maternal education levels were important in influencing the development of healthful food habits among children.

Data from the study on marihuana consumption in San José indicated that while most subjects reported that meals were prepared and served at regular hours in their homes, because of employment hours at least half of the males did not eat at the same time as the rest of the family. The rest of the family (mother/wife, children, and other), however, generally followed a regular schedule for meals (Rawson and Phillips Arizmendi 1976:589-590).

Alcohol use by a parent was cited as a cause for going hungry and other unhappy childhood experiences which could directly affect the nutritional status of young children. Slightly less than half of marihuana users and nonusers had fathers who drank heavily (True et al. 1976; True 1976).

A model was developed based on prior work done in San Ramón, a small village, and the surrounding rural area by Rawson (1975). This model was modified to make it more appropriate for testing in the urban situation and to include most of the risk factors already mentioned. Figure 2 illustrates this model. The model was to be tested through the collection of extensive biocultural data and by use of a mixed cross-sectional and longitudinal design. Both the methodologies and the model were to be evaluated for applicability to other urban settings.

Unlike Rawson's study (1975) in which the basic independent variable was access to an adequate amount of agricultural land (i.e. two manzanas, or 1.4 hectares), this study used a factor labeled "real

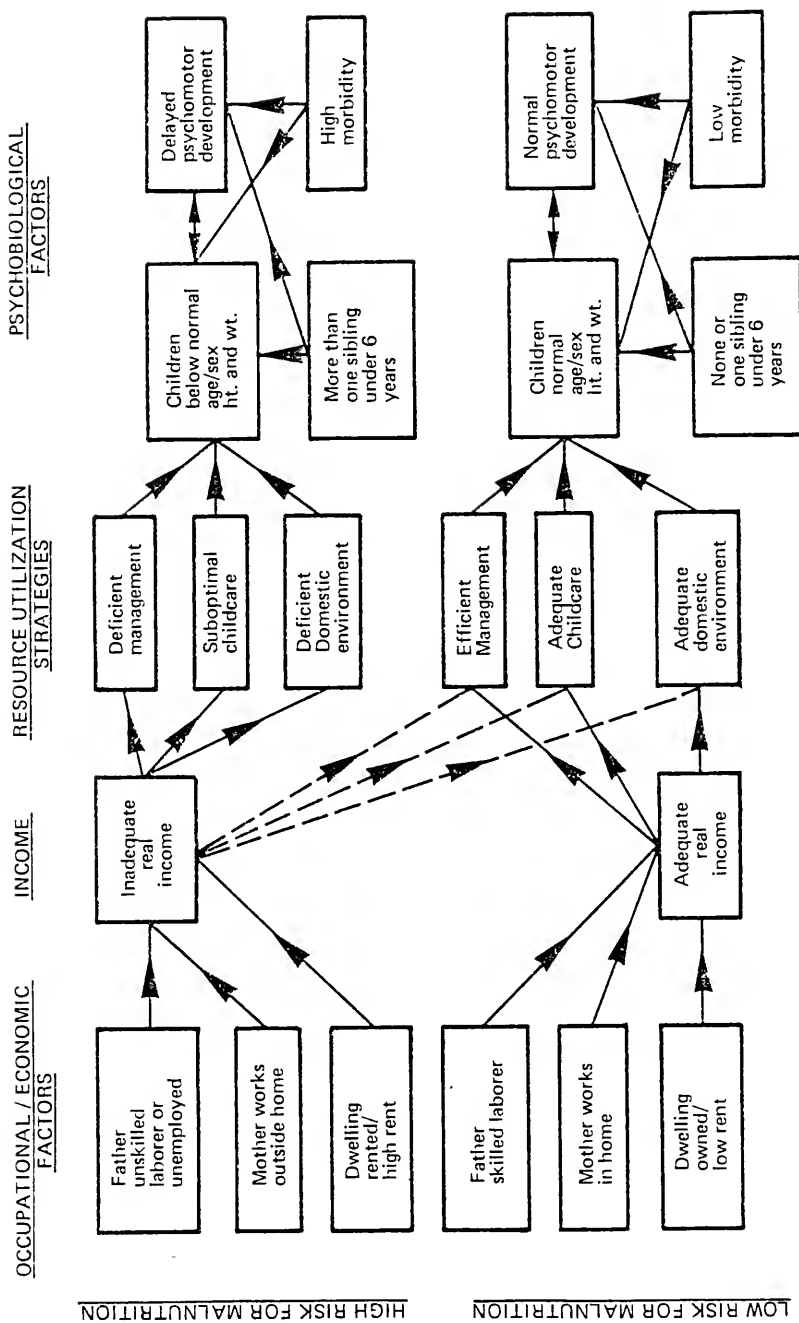


Figure 2. Model of Risk Factors for Childhood Undernutrition. Derived from Rawson (1975) and Rawson and Valverde (1976).

income." "Real income" is composed of wages, credit, savings, monetary gifts, inheritance, etc., averaged weekly to allow for variations such as seasonal ones. There were a number of intervening variables involving the allocation of resources, the adequacy of the physical environment, and the quality of child care. These variables were directly observable and measurable and are described in Chapter III in the section on methods.

One of the objectives of the study was to augment the community-based nutritional research completed by the Ministry of Health, the National Institute for Health Research (INISA), and the Costa Rican Institute for Research and Training in Nutrition and Health (INCIENSA). The project emphasized a longitudinal, in-depth behavioral approach which was used to delineate the variables and diversity of coping strategies leading to poor and well nourished children among the urban poor. This information will be used to characterize that portion of the population which is at greatest risk for malnutrition and to assist in the development of intervention programs which are targeted specifically at the high risk group. This approach has as its goal the conservation of scarce resources by facilitating directed programs which provide the greatest return on invested materials and manpower. The identification of risk factors and strategies which lead to malnutrition on the basis of household data can be extrapolated for use on the community level.

CHAPTER III METHODS

Phase I: Setup

Contacts

In my position as field director of the project, I traveled to Costa Rica in August 1981. The appropriate contacts were made with the project consultants, Dr. Carlos Diaz Amador, director of the Department of Nutrition of the Ministry of Health, and Dr. José A. Camacho, professor of anthropology at the University of Costa Rica. Through these individuals, contacts were made with the director of the Community Health Program, Dr. Enrique Freer Miranda, and Dr. J. Manual Alvarado Obando, director of Health Region 1, which has metropolitan San José in its jurisdiction. After obtaining the appropriate authorization, contacts were made with the directors and personnel of all the health centers from which the samples of children were to be drawn. This selection was made with the aid of Dr. Diaz Amador and Dr. Camacho and by use of the criteria of a large population of poor people and, where possible, areas which had not been overstudied by various investigators in the past.

Spanish translations of the proposed project and the permission form to be used for inclusion of each child in the study were presented to the Ministry of Health and were approved.

Archival Research

Archival research was carried out in the libraries of the University of Costa Rica, the National Children's Hospital, the Costa Rican

Institute for Research and Teaching in Nutrition (INCIENSA) at Tres Ríos, the National Museum, and the Ministry of Health. Documents were also obtained from the National Office of Planning (OFIPLAN), the National Nutrition Information System (SIN), the Ministry of Health, and the National Institute for Research in Health (INISA).

Interviewers

Through the auspices of Dr. Enrique Freer Miranda, head of the Community Health Program at the time of this study, two women who had worked for four years as health auxiliary workers in the Hatillo Health Center were hired. These two women, Flory Desanti Jimenez and Eulalia Obando Naranjo, worked with me to develop the survey instruments, assisting particularly with translation of the language to the idiomatic Spanish of the urban lower class. They were also trained to conduct structured interviews, do anthropometric measurements, and give the Denver Developmental Screening Test (DDST).

Pretest

With the help of the two interviewers, 10 households were chosen from various neighborhoods which had people similar to the sample population but which were not to be included in the survey. In these households children were weighed and measured, interview schedules were filled out, and the Denver Developmental Screening Test (DDST) was given. Polaroid photos were taken and left with each family.

In addition to this pretest situation, prior to the beginning of the formal study, about 70 children from a squatter settlement were measured and weighed to provide additional training in measurement techniques for the research assistants. These children are not included in

this study, however. The DDST was also given to 30 children with myself, Flory, and Eulalia scoring each test simultaneously. By the time the formal investigation was begun, everyone was comfortable with all instruments and procedures. There was also very little variance in the manner with which each procedure was carried out.

Phase II: Initial Survey Target Population
and Sampling Design

Greater San José—San José and surrounding urban areas—had a population in 1973 of 837,000 which is projected to reach 1.8 million people by the year 2000, increasing the present labor force from 260,000 to 500,000 persons. In 1976 there were more than 240 slums in the metropolitan area in which there were one-room shacks occupied by several families, according to a USAID report (1976). According to this report, there were an estimated 110,986 families in Costa Rica (average family size—6 persons) which were considered mas pobres ("more poor" or "poor poor") with incomes of less than \$825 per year. Of these families 40.6% (45,000) lived in greater San José. In addition, there were 197,268 other families who were considered pobres ("poor" or "rich poor") with incomes below \$1,395 per year. Of these families 53% (104,610) lived in the greater San José area. The income figures are based on census data and primarily refer to salary income. More recent data was difficult to obtain because similar USAID reports and Costa Rican government reports are now considered classified material and I was not allowed access to them. It is doubtful if the situation described has changed much for the better, however. If anything, things are probably worse because Costa Rica has suffered an economic crisis and inflation has changed the value of the colon from ₡12.50 per \$1 to

¢40-60 per \$1 in 1981-82. Times are tougher and Costa Rica has been hard pressed to try to pay off its foreign debt. It has also had a tremendous influx of refugees from Nicaragua, El Salvador, and Guatemala, an additional drain on the economy.

Seven health centers were selected as sites for obtaining the sample population. They were Hatillo, Alajuelita, Pavas, Tibás, Paso Ancho, Guadalupe, and Cristo Rey. The areas selected were known to have a high percentage of poor people. Figure 3 shows the distribution of this population. Although each of these health center regions has some more well-to-do neighborhoods included in its jurisdiction, only areas noted as very poor were selected, e.g. Calle Blancos, Cinco Esquinas, Concepción de Alajuelita, La Esperanza in Pavas. A sampling frame was constructed from birth records kept by each health auxiliary worker for his/her district. All the children born in 1980 in each of the areas selected were placed on a list and given a number. A table of random numbers was used in selecting over 200 children. After each child was selected from the birth registry, his or her family record was located and the address and other social data noted. About 50 to 60 of these could not be located in the files of the health auxiliary workers. Another 25 to 30 were located in the file but when the health auxiliary worker arrived in the neighborhood, they had moved and left no forwarding address. The final large sample contained 107 children. In each of these 107 families, a family registry, or listing, of all members of the household, their ages, sex, education, and migration history was taken. In addition to these data a medical history of the child during the past year, an assessment of material level of living

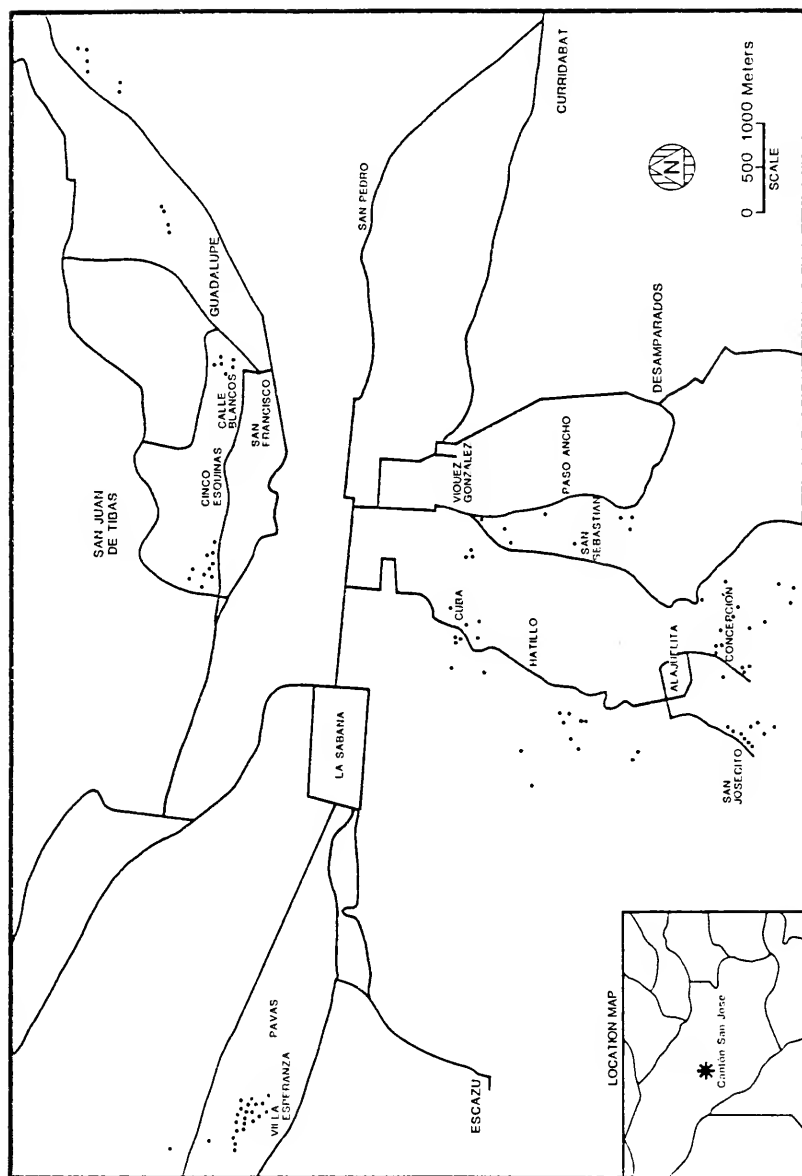


Figure 3. Map of Metropolitan San José Showing the Distribution of the Large Sample of Children from Poor Urban Barrios.

and quality of the environment, an examination of the child for clinical symptoms of malnutrition, and anthropometric measurements of the index child were obtained. The Denver Developmental Screening Test (DDST) was also performed on this initial visit. (See Appendices 1-5 for examples of the forms used.)

Anthropometry

The following measurements were carried out according to the IBP Handbook protocols (Weiner and Lourie 1969).

Length. This was taken in centimeters by use of a headboard with a metal tape measure attached which could be taped to a hard surface such as the floor or a table. Another board was then held up to the bottom of the feet to determine the length. This instrument was adapted to fit into a shoulder bag because bus transportation was used at all times.

Weight. In the interest of making the instruments portable, it was decided to use a bathroom-type scale. Most of the children being measured could walk; therefore this was not a problem. Three scales were obtained; each of these was tested with standard weights up to 30 kilos and found to be accurate. Thereafter they were tested every 6 weeks. Before use the scales were placed on zero. The weight was obtained with the child wearing light clothing and without shoes.

Triceps and subscapular skinfolds. These measurements were obtained in millimeters with Lange skinfold calipers. These measurements were taken on the large sample at the beginning of the in-depth study and at the end of the in-depth study. It was decided not to take them each time because of the difficulty of doing this accurately with children and because of the need to have only one person take the measurements. Thus, I took all the skinfold measurements.

Arm and head circumference. These measurements were taken in centimeters with a fiberglass nonstretchable measuring tape.

Denver Development Screening Test (DDST)

The Denver Developmental Screening Test is a simple and effective way of assessing the developmental status of children during the first 6 years of life. It evaluates the following aspects of the child's functioning: Gross motor, fine motor-adaptive, language, and personal-social areas. The test relies on observations of what the child can do and on reports by a parent or parent surrogate who knows the child. Direct observation is used whenever possible. The younger child may be tested while sitting on the mother's lap, which is the procedure we used. The test is easy to administer, score, and interpret and is useful for repeated evaluations of the same child. The test has a high rate of validity and reliability (Camp et al. 1977; Frankenburg and Dodds 1967; Frankenburg et al. 1971a, 1971b, 1971c). It is not an intelligence test but is intended as a screening instrument for use in clinical practice to note whether the growth and development of a particular child is within the normal range.

Because the DDST was standardized on the Denver population, it has been noted that some of the norms are not applicable to children in other cultural areas (Bryant et al. 1974; Solomons and Solomons 1975). It has been successfully adapted and standardized for use in Japan and Okinawa (Ueda 1977a, 1977b). It has been translated into Spanish and has been used to some extent in Guatemala, Chile (Fandal 1980), and Yucatan, Mexico (Solomons and Solomons 1975). The test has also been used cross culturally in the United States (Frankenburg et al. 1975). Upon arriving in Costa Rica,

I discovered that research conducted by the University of Costa Rica had been carried out to standardize the DDST for use in Costa Rica and Central America (Howard and Nieto de Salazar 1982). However, because this standardization was not yet complete and because of what I perceived as problems with the design of the standardization research, I decided to use the official Spanish version of the DDST, which had been obtained from the La Docca Foundation in Denver, Colorado. Because the comparisons to be made were to be within a cultural group rather than between cultural groups, I felt that the results from this point of view would be valid in spite of any possible cultural biases inherent in the test. However, many of the suggestions developed by the Costa Rican group to facilitate administration of the test to the local population were incorporated.

The DDST was given on the first visit to all 107 children included in the sample. After it was explained and demonstrated, it was found to be of great interest to the people and proved to be an excellent entree, providing parents with graphic demonstrations of their children's abilities in various areas. It was repeated once more, after at least three months had passed, on the smaller group of 44 children included in the in-depth study.

Material Level of Living:
Quality of Environment

A checklist was used to assess the material level of living, e.g. presence or absence of radios, TV's, sewing machines, and other indicators of quality of life. Quality of the living environment was also assessed with an evaluation of the condition of the house, type of

construction, number of rooms, number of people per room, number of beds, type of cooking facilities, disposition of excreta and garbage, lighting, ventilation, and other aspects of the environment (see Appendix 4).

Assessment of Clinical Signs of Malnutrition

A list of symptoms of primary clinical malnutrition was developed by use of the form suggested by Rawson (1975) which was then adapted for use in San José with the aid of Dr. Carlos Diaz Amador, director of the Department of Nutrition of the Ministry of Health. (See Appendix 6 for a copy of this list). I performed this examination on all the children.

Phase III: In-Depth Longitudinal Study

Because the initial large sample showed very few children at or below the fifth percentile of weight for height when the NCHS statistics were used (probably because of the excellent national program of nutrition, surveillance, and intervention), it was decided to focus on the mildly to moderately undernourished child, victim of invisible malnutrition, as it has been termed (International Health News 1983), currently the major problem for Costa Rica and many other developing countries.

The criteria for severely undernourished children are quite clear, e.g. fifth percentile or below on the growth charts of the National Center for Health Statistics (NCHS), 80% of the median or below, again on the NCHS growth charts (Mata 1978a; Waterlow and Rutishauser 1974), or second and third degree malnutrition by the classification of Gómez (1956). On the Gómez scale, which is based on weight for age, normal

is 91-110% of standard weight for age, first degree malnutrition is 79-90% of standard weight for age, second degree malnutrition is 61-75% of the standard, and third degree malnutrition is 60% or less of the standard (Gómez et al. 1956:77). In recent years the classification of Gómez et al. has come under criticism because it is based on standards developed among much heavier children than is the norm in Latin America and other parts of the third world. Mata (1978a) notes that it was developed more than 20 years ago as a means of categorizing children admitted to the hospital for treatment of malnutrition and was not intended to apply to the general population. Generally the trend has been to use weight for height as the criterion for determining acute malnutrition, and height for age as the indicator of long-term nutritional status. Recently the concepts of wasting (deficit in weight/height) and stunting (deficit in height/age) have been introduced to allow populations to be classified in different groups for intervention purposes (Mata 1978b; Waterlow and Rutishauser 1974).

As mentioned already, the criteria for severely undernourished children are clear; however, the cut-off point for delineation of mildly undernourished children with subclinical malnutrition is not so easily determined. The Costa Rican Ministry of Health uses growth charts based on NCHS standards and considers children to be moderately undernourished if they are at or below 90% of the median. Because of a decision to focus on the mildly to moderately undernourished child, the in-depth sample included all those children who were at or below 90% of the median of NCHS standards and/or had at least first degree malnutrition by the scale of Gómez et al. Originally there were 26 children falling

into this category. Two were eliminated because they had had illnesses shortly after birth (meningitis and encephalitis) which had left such effects that it would have been impossible to say what retardation in growth and development was due to undernutrition and what was due to disease processes and their residuals. Of the 24 left, only 19 agreed to participate. Another group of children was selected, by use of the table of random numbers, from the remaining 81 normal weight/height children. The families of 25 of these children agreed to let them participate in the in-depth study. In the end there were 26 males and 18 females participating. Ten of the females and 9 of the males were in the low weight/height group. Eight of the females and 17 males were in the normal weight/height group. Among the normal group, the random selection yielded very nearly an equal number of boys and girls. The difference apparently results from the fact that more of the parents of boys were willing to let them participate than were parents of girls. It is not certain whether this is a chance occurrence or some cultural bias having to do with boys and their roles and position in society.

Long-Term Data Gathering

The plan had originally been to pick up the children to be followed in groups of 10, adding another increment of 10 each month until all were being followed and then gradually tapering off as the 6 months of surveillance were reached. At the time the in-depth portion of the research was to begin, however, the political situation in Costa Rica and all Central America seemed quite tense. It was just prior to the elections, there had been some terrorist activity, arms caches had been

found, and there had been border incidents with Nicaragua. Because of these factors and because the interviewers proved to be very capable and easily trained, a decision was made to carry all the families simultaneously, visiting each family every month for measurements and additional data gathering. Each visit had to be made within six days either before or after the date which equaled one month exactly from the last visit. The object was to make the data-gathering period as compact as possible in case there developed a situation in which the ability to visit families living in slum areas would be interrupted. This arrangement worked out well, proving to be a better plan than the original.

In addition to the family registry, anthropometry, medical history of the child, checklist of material living conditions and quality of the environment, and assessment of clinical malnutrition already mentioned, several other types of data were obtained.

Assessment of Socioeconomic Status

This interview schedule included data about the occupations, income, expenditures, gifts, etc., of all members of the household. Because of the sensitive nature of these data and our wish to keep everyone in the study for all of the 6 months, this schedule was not administered until we had been visiting the family about 4 or 5 months. Only after that time did we feel enough rapport had been established to enable us to attempt to elicit information about socioeconomic status with any accuracy. (See Appendix 7 for a copy of this schedule.)

Weekly Marketing Items and Food Budget

With the help of the two interviewers, a schedule was constructed which elicited the frequency, place of purchase, and cost of the foods

commonly purchased. This information was used to construct a monthly food budget and was generally elicited at the same time as the socio-economic data, both being rather sensitive in nature. In addition to this information, shopping lists were obtained from several families and other families were accompanied on food-buying trips by myself. The object of this data was to determine what kind of access people had to food supplies and how they allocated their resources with respect to food purchasing (see Appendix 8).

Maternal Reproductive History

This schedule included data about parity, number of pregnancies, complications of pregnancy, miscarriages, length of pregnancy, and patterns of breast-feeding. This material was not deemed to be sensitive because women tend to talk with each other and other people about their ills and pregnancies, thus it was administered early in the study to the mother of the index child. Generally, the women seemed to enjoy reminiscing about their pregnancies and problems associated with them. (Appendix 9 contains a copy of this schedule.)

Dietary Data

In addition to buying patterns relative to food, dietary data were elicited in two ways. The first was a 24-hour recall of what the index child had eaten. Four of these were obtained, one for the weekend and one for the weekday during the dry season (December to April) and one for each weekend and weekday during the rainy season (May to November). Because of the difficulty of being able to arrive on the appropriate day for the recall, some were done by us as 24-hour recalls and the rest

were left with the mother or mother substitute to be filled out as a diary for the day needed, e.g. a Saturday or Sunday. We did not have high hopes for the success of this method and only resorted to it several months into the study when we lacked needed data. Much to our surprise, the mothers were highly motivated and we received all but two reports back. These data were not used as a way of determining individual intake because of the errors inherent to recall data (Acheson 1980; Bernard et al. in press; Morrison et al. 1959) (e.g. 20-50% rate of error in recording intake), but rather as a way to get an idea of the typical diet of the child in relation to family food consumption and customs associated with mealtimes.

Q-Sort Techniques

A Q-sort of 100 cards of local foods most frequently consumed was devised. The Q-sort techniques have been adapted from Stephenson (1953). Correlational methods for analysis of ordinal and nominal data were employed as suggested by Cohen (1957) and Wittenborn (1961). The Q-sort used in this research was adapted from that described by Fitzgerald (1977), who used it to develop a food choices game. The same type of game was developed for this study and was adapted to local food habits. Fitzgerald noted that the advantage of using this type of approach rather than just an interview to elicit recall data is that it is non-threatening and involves active participation. We found this to be true. Even though the mother, or the principal caretaker, of the index child was the one asked to perform the sort with the food cards, many times it ended being a family consensus, which is probably a more accurate reflection of the food habits of the family anyway according to the

findings of Bernard et al. (in press) regarding the increased accuracy of recall data among groups as compared to individuals. Five different kinds of information about food habits were elicited by use of this procedure (not all at the same time). First a food frequency test was done. Then the mothers were asked to sort those foods most liked and least liked, those considered most nutritious and least nutritious, those most appropriate for the index child, and the informant's own classification of the 100 cards by whatever criteria she cared to devise.

Observation of the Index Child

In addition to the data mentioned already, each child was observed for 4-5 hours during the morning of one day. Procedures described by Spradley (1980) and Wilson (1977) were incorporated into an adaptation of child-following as described by Wilson (1974). The behavior of the child and the family in general were the target of this observation. Although what was eaten by the child during the time the observer was there was recorded, these data were not used to determine the intake of the child but rather to learn something about mealtimes, intrafamily food distribution, how the child was cared for, how he/she ate, and family interactions. Because of the large number of children to be observed in a relatively short time, it was considered unfeasible to carry out child-following as Wilson had described it. Instead an attempt was made to observe during a similar period of time in each household in the same way so that the observer bias at least would be the same and, it was hoped, the data would provide a sample of what happened during the same period of time in each child's day. This observation was done only after at least 3 or 4 visits monthly had been carried out. Because it is rather

inconvenient for a family to have a stranger in their house for half a day, appointments were set up in advance. The observations were carried out only by myself. The people were very cooperative and, although undoubtedly some things were changed because of prior knowledge of the visits, i.e. the house was made cleaner and perhaps a special effort with the food served was made, the observations were believed to be of great value in understanding the family environment. The cooperation of the family seemed to be enhanced also by the fact that we made appointments with them. Although the sampling procedures may have suffered because people knew an observer was coming, rapport with and confidence in the researchers were increased.

The total observation period was usually 4-6 hours in length; however, the child's behavior was recorded every 15 minutes for 3 minutes on a checklist during only 3 hours of that time. Ethnographic notes were recorded every 15 minutes during the entire observation period, and included information about behavior, food eaten, and any other activities which were of interest (see Appendix 10 for a copy of the checklist of behaviors). The family was informed before the observation was set up that I would be making notes of the child's behavior. Because the focus of attention was on the index child, the pressure was taken off the other family members to a large extent, thus making them more at ease. A short, informal history of the family was also included at the end of the observation because by that time I had been able to elicit that kind of information. Photos were also taken to illustrate some of the child's behaviors. Because photos are expensive, they were taken only when the child changed behavior rather than every 15 minutes.

A copy of the photos was given to each family. This gesture was very well received.

One of the interesting offshoots of this in-home observation was a first-hand acquaintance with Costa Rican cuisine because I was expected to eat with each family. Because among Costa Ricans sharing food is an integral part of social behavior, these invitations were not to be taken lightly, even though most families could ill afford another mouth to feed. I used the opportunity dining with each family presented to gather data about typical menus served. A wide range in the quality of the cooking was noted; some food was excellent and some was terrible. I found that good cooks can make tasty dishes with very little money to spend.

Fees Paid to Subjects

In order to provide an incentive for each family to remain in the study for the entire time, the project had been set up to pay a certain fee each month. Originally this sum had been set at \$5; inflation, however, had so affected the exchange rate that this sum had become a fairly large amount in colones. The project advisors, Dr. Diaz Amador and Dr. Camacho, did not believe that it would be wise to pay that sum because it would set a precedent which could make data gathering harder for other individuals and organizations whose budgets did not include money for fees to be paid to subjects. It was also feared that too high an amount would affect socioeconomic status unduly. The sum finally agreed upon was ₡125, which was at the time the equivalent of \$2 and was approximately the amount a semiskilled worker would receive for a day's wages. The extra money was used to give each family the

photos mentioned earlier and for a small gift for each child at the end of the study.

I believe that the monthly sum did help keep a number of the families in the study, particularly those who were extremely poor. I provided each family with my telephone number and instructions to call me if they were going to move so that we could get directions to the new home. Also they were to call if for some reason they could not be there on the day we were to visit, because we were trying very hard to be as precise as possible in getting measurements at one-month intervals. I really had no great hopes that people would call because almost all had to use public telephones, but much to my surprise I regularly got calls advising me of changes needed in scheduling, and of changing addresses from those three families who proved to be nomadic. Also a number of the mothers began to call periodically to ask advice about many things. One of the ideas I tried to impress upon each family was how important the information they could give me was. Because I regarded their input as important, they too seemed to take things more seriously. At any rate we lost none of the 44 families during the 6 months of observation.

Table 3 presents a summary of the various methods used, along with their frequency, who performed them, and which informant was used.

Phase IV: Data Analysis

The data were coded and entered into the computer for data manipulation and analysis. The Statistical Analysis System (SAS) was used for descriptive and inferential statistical analyses, including multivariate techniques for correlation, analysis of variance, and various

Table 3. Summary of Methods

Instrument/ technique	Pretest	Survey	In-depth study	Frequency in-depth study	Subject	Investigator ^a
<u>Interview schedules</u>						
Family registry	x	x	x	1	Mother/caretaker of index child	FD/HA
Socioeconomic schedule	x		x	1	"	"
Marketing/ food budget	x		x	1	"	HA
Reproductive history	x		x	1	Mother of index child	FD/HA
Child's medical history	x		x	1	Mother/caretaker of index child	FD
24-hour dietary recall	x		x	4		FD/HA
<u>Checklist</u>						
Material level of living (household environment	x	x	x	1	Household	HA

Table 3—(continued)

Instrument/ technique	Pretest	Survey	In-depth study	Frequency in-depth study	Subject	Investigator ^a
<u>Q-sorts</u>						
Food frequency	x		x	1	Mother/caretaker of index child	FD/HA
Appropriate for child	x		x	1	"	"
Most/least liked foods	x		x	1	"	"
Food classification	x		x	1	"	"
Most nutritious/ least nutritious	x		x	1	"	"
Anthropometry	x	x	x	7	Index child	"
DDST	x	x	x	2	"	"
Child following	x		x	1	"	FD

^aFD = field director; HA = auxiliary worker.

nonparametric statistical techniques. These statistical analyses, along with a discussion of the results, will be discussed in more detail in Chapters IV and V.

CHAPTER IV
SOCIOCULTURAL PARAMETERS AFFECTING THE NUTRITION, GROWTH,
AND DEVELOPMENT OF THE CHILD

Family Networks

Social interaction in Costa Rica is based on kinship. At all levels of social class, the persons with whom an individual is most likely to celebrate New Year's Eve or Christmas, or upon whom he or she depends in times of emergency, are family members. First impressions may lead the outsider to assume that there exists a great deal of "neighboring," i.e. interaction between nonrelated individuals who live close to one another. A closer look, however, will show that in most cases where neighbors interact they are also related. The barrios in which this study was carried out were dotted with clusters of two or more related families. Over 50% of the 44 families in the in-depth study had relatives as neighbors.

Although the scope of this research did not include a rigorous description of the networks which do exist, an acquaintance of any depth and over a length of time will automatically bring one in contact with these kinship-based networks. Usually there are two major networks within each household: one with the wife as a link to her family and the other linking the husband to his family. Sometimes one of these two networks may be nonfunctional, depending on the physical distance between family members and the strength of their relationship with one another.

The basic importance of the family within the overall Costa Rican social structure has ramifications for the nutritional status of the child. Among the families followed, I found this kin-based network to be the primary source of financial assistance in times of economic depression, not unlike the situation observed by Safa (1974) in the Shantytown families of Puerto Rico. It is also the main source of mother substitutes or child caretakers should the mother of a child need to work or should something happen to her. There is a lot of food sharing, not only of foodstuffs but also of meals eaten at one another's house. The latter is particularly important for children.

True (1976), in the study of marihuana users, mentions that among the poor there are two social spheres, that of the woman and that of her husband or companion. My research did not contradict this finding but rather found the same kind of division. My experience, however, put me in contact primarily with the people included in the maternal networks.

Family Structure

Of the 44 families in the in-depth study, 11, or 25%, were matri-focal families. Only one did not fit the definition of the "Queen Bee," or "grandmother," matrifocal family described earlier. The one which did not fit was a "Queen Bee" type which had broken down; i.e. the grandmother and great grandmother had refused to let a granddaughter and her children live with them any longer. However, she still spent most of the day with them. It was also noted that "Queen Bee" families could include grown sons who were not married.

Of the 44 families, 11, or 25%, were extended families. The extended family as I found it included various persons from different nuclear families, although these might not be complete families, e.g. daughters or sons and their children and possibly a spouse. The extended family always had a male as its head, however.

Of the 44 families, 22, or 50%, were nuclear families. In San José, however, the designation nuclear family can be misleading. For example, I followed two children from nuclear families who lived in one of the barrios of Alajuelita. The first family consisted of Miguel and Antonia and their two children. They lived in a complex of three other separate houses on the same block. Antonia's parents lived in front; her sister, at one side; and her brother, in a house behind their house. They all shopped together on Saturdays (at the farmer's market or the central market) and the children were in and out of all the houses and could eat at any of them. Goods, food, and services were exchanged freely. For all practical purposes, they functioned as an extended family but had separate dwellings.

Not far from Miguel and Antonia, another family lived in similar circumstances. José and Sara lived as a nuclear family with their three children; however, they too lived in a family complex consisting of several of José's brothers, a sister, and his parents. Figure 4 shows this layout—a pattern frequently found among the families in this study and also among many middle and upper class families who were social acquaintances. Thus it seems to be that the term nuclear family has a very different connotation in Costa Rica from that existing elsewhere. The main difference between the nuclear family and the

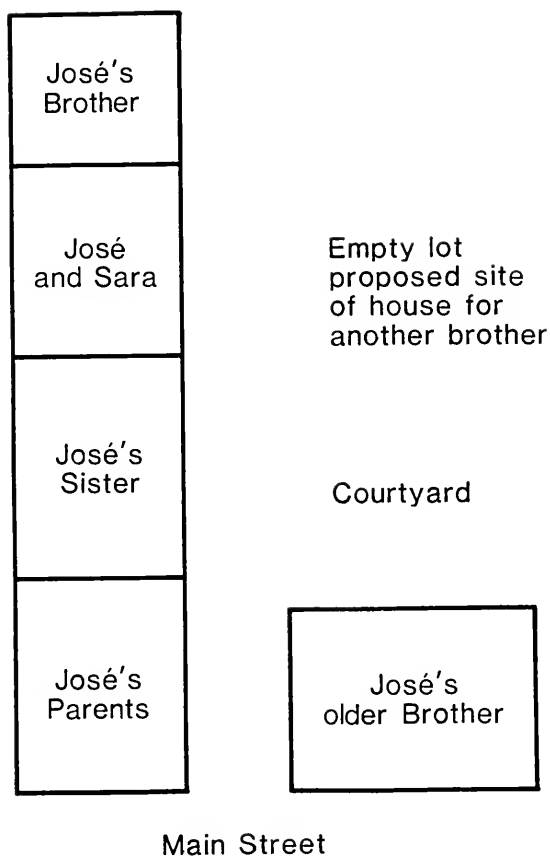


Figure 4. Diagram of the Family Complex of José and Sara.

extended family in many cases is that in the former the family members have separate roofs and may cook separately; otherwise they act much like a traditional extended family.

R. T. Smith (1970) had observed almost 30 years earlier that matrifocality is associated with a class position at the lowest rank of society. Vertical mobility is limited and the men are usually unskilled laborers holding jobs which have little prestige. He sees matrifocality as being the final phase of a cyclical process which includes a period of sex experimentation and spouse selection, the nuclear family, and finally the matrifocal household, which occurs when the role of wife-mother gradually gains dominance over the role of husband-father.

In Costa Rica, as greater job opportunities have become available for women in the textile and garment industries, women have become more independent, a phenomenon Safa (1974) also found in Puerto Rico. With this independence has come a decreased need for marriage to obtain financial security and thus leaving little, in many cases, to hold a man and his wife together. Here as in Puerto Rico, each is bound to his/her own kin group, blood ties being more important than marriage. Given this situation, marital problems such as alcoholism or unemployment on the part of the husband have tended to result in the formation of the matrifocal family. The "Queen Bee," or "Grandmother," family seems to result when daughters, able to obtain employment, find formal marriage unnecessary or impractical because they can remain in their mother's house and raise their children there. Increased availability of employment for women may be encouraging a trend toward elimination of the nuclear family phase of family evolution described by Smith.

The Program of Social Welfare and Family Aid (Programa de Desarrollo Social y Asignaciones Familiares), which has been created to aid low-income children and pregnant and lactating mothers, may have a tendency to make poor families, particularly female-headed families, more dependent on public aid, not unlike the situation described by Safa (1974:46) for urban Puerto Rico.

As noted earlier, in Costa Rica the matrifocal family particularly the "Queen Bee," or "Grandmother" variant, has been considered an excellent adaptive mechanism enabling poor women to obtain economic necessities and care for their children and to educate them (Lopez de Piza 1979:15). The data gathered in this study tended to verify this finding. Only 3, or 27%, of the matrifocal families had children in the low weight/height group. Although income on the family level did not differ significantly between male-headed and female-headed households, per capita income did. Female-headed households had a per capita income of ₡580/month (\$14/month based on an exchange rate of \$1/45) whereas male-headed households had a per capita income of ₡821/month (\$18/month). The general linear model (GLM) (SAS, 1982) was used to run an analysis of variance and a Duncan test of the means. This analysis indicated that female-headed households were significantly larger, with a mean of 8.1 persons as opposed to 5.7 in male-headed households ($F=7.34$, $p \leq 0.01$). In general, then, female-headed households had smaller individual salaries but there were more persons working and pooling resources, which compensated for the low salaries.

An example of this phenomenon is the household of Doña Pilar, who left her husband years ago because of his drinking. She lives with her daughters and three grandchildren. Three of her daughters work in

the garment industry, making clothing. Sara and Reina work in a factory; Luz works in a smaller establishment. Yolanda, the youngest, has been under treatment for psychiatric problems. Doña Pilar cares for the children and also sews at home. (Figure 5 shows a diagram of this family.) The three working daughters earn ₡2400, ₡2000, and ₡1200 respectively for a combined income of ₡5600 (\$124) per month, which puts them slightly above the mean for female-headed families (\bar{X} =₡4697, or \$104) and for male-headed families (\bar{X} =₡4719, or \$105). A total of ₡3742 (\$83) is spent on food each month and ₡650 (\$14) for rent and utilities. This leaves ₡1208 (\$27) to be spent on clothes and other incidentals. They receive medical care through the social security clinics and the neighborhood health center. They speak of wanting to move to a new housing project but remain where they are because rent is cheap, allowing them to spend more on food, clothing, and other incidentals.

Food-Buying Patterns

Relating family structure to food-purchasing patterns, I found that in the female-headed household the person in charge of purchasing is usually also the principal child caretaker. This means that the buyer for a female-headed household has much less mobility and greater dependency on local corner grocery stores (pulperías) and street vendors whose products are usually more expensive. She has the alternative of taking small children along, leaving them alone for a period of time, or sending an older child to the store with a list of groceries.

In male-headed families, in contrast, 36% of the time the man is the main buyer and 39% of the time both the husband and wife do the shopping. Only 12% of the time is the wife the principal buyer.

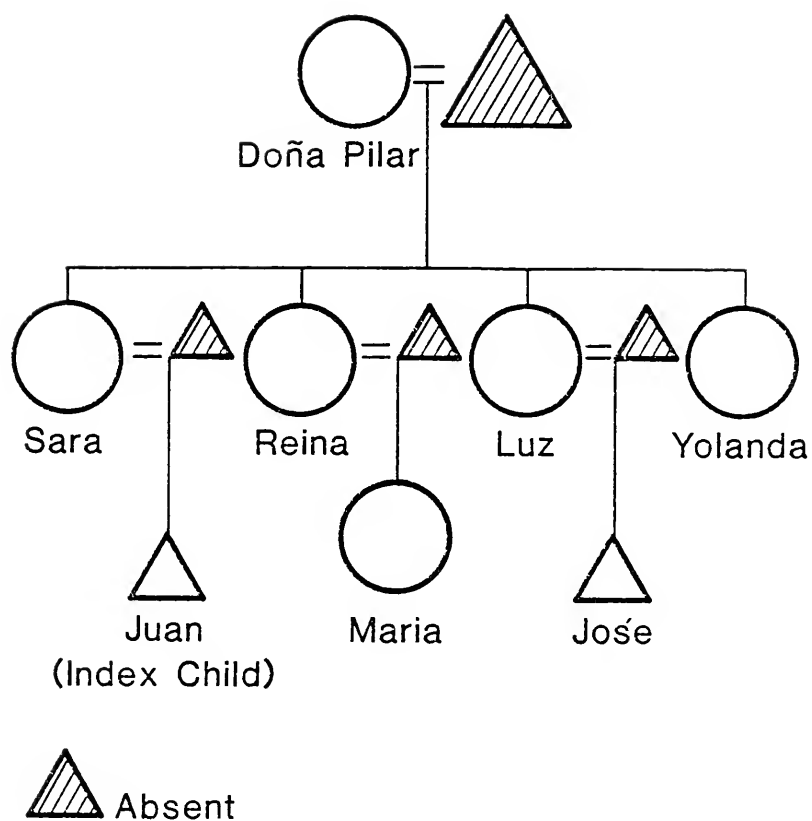


Figure 5. Kinship Chart of the Family of Doña Pilar. This is an Example of the Extended Matrifocal, or "Queen Bee," Family.

In general, male-headed households were better able to patronize the subsidized state-run food outlets, the central market, larger grocery stores (almacenes), and other places which tend to offer better prices, whereas female-headed families were dependent on what could be bought within walking distance. Male-headed households spent an average of ₡3884 (\$86) per month on food, which was 82% of the total family income. Female-headed families spent an average of ₡3790 (\$84) per month, or 81%, of their total family income. Per capita expenditure on food, however, differed more. Male-headed families spent ₡670 per capita (\$14), whereas female-headed families spent ₡468 per capita (\$10) per month (see Table 4). All families used bus transportation and most bought groceries with cash (over 90%) rather than on credit. Family members tended to get food or money to buy food from their kin networks rather than having the local corner grocery store extend credit.

Child Rearing

Children occupy a favorable position in Costa Rica. The birth of a child is usually a welcome event. Lomnitz (1977) notes that in Mexico this attitude is common among members of marginal populations because children represent a potential cheap source of income. Their cooperation is dependable and the cost of their maintenance insignificant. The same is apparently true in Costa Rica among the poor, although children also seem to be valued for themselves, as family members and as sources of pride and prestige. Positive attitudes toward children are evident throughout Costa Rican society. At the national level the Patronato Nacional de la Infancia has been formed to serve as the watchdog of children's rights. Over 60% of community health

Table 4. Summary of Where Food Is Purchased in Female-Headed and Male-Headed Families Among a Sample of Urban Poor Families in San José

Food item	%															Total
	Pulperia ^a	Supermarket	State food outlet	Central market	Almacén ^b	Butchershops	Greengrocer	Bakery	Farmer's market ^c	Milkman	Farm	Vendor (cart)	State liquor store	Other	Did not buy	
Bread																
Female	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	100
Male	61	—	—	—	—	3	3	21	—	—	—	—	—	12	—	100
Liquid milk																
Female	45	—	—	—	—	—	—	—	—	9	—	—	—	—	46	100
Male	46	—	—	—	—	—	—	—	—	21	—	—	—	9	24	100
Dried Milk																
Female	27	18	—	—	—	—	—	—	—	27	—	—	—	—	28	100
Male	15	6	6	—	—	—	—	—	—	—	—	—	—	21	52	100
Eggs																
Female	82	—	—	—	—	—	—	—	—	9	—	—	—	—	9	100
Male	36	—	6	9	3	—	—	—	—	—	40	—	—	—	6	100
Vegetables																
Female	9	—	—	28	—	—	27	—	9	—	—	9	—	—	18	100
Male	6	—	—	34	—	—	30	—	12	—	—	15	—	—	3	100
Fruit																
Female	18	—	—	9	—	—	73	—	—	—	—	—	—	—	—	100
Male	15	—	—	15	—	—	49	—	9	—	—	6	—	—	3	100
Rice																
Female	55	9	9	—	—	—	—	—	—	—	—	—	—	9	18	100
Male	24	15	34	—	21	—	—	—	—	—	—	—	—	6	—	100
Beef																
Female	—	9	—	—	—	91	—	—	—	—	—	—	—	—	—	100
Male	—	6	—	9	—	82	—	—	—	—	—	—	—	—	3	100

Table 4—(continued)

Food item	%															Total
	Pulperia ^a	Supermarket	State food outlet	Central market	Almacén ^b	Butchershop	Greengrocer	Bakery	Farmer's market	Milkman	Farm	Vendor (cart)	State liquor store	Other	Did not buy	
Pork																
Female	—	9	—	—	—	36	—	—	—	—	—	—	—	—	55	100
Male	—	6	—	9	—	21	—	—	—	—	—	—	—	—	64	100
Beans																
Female	55	9	18	—	—	—	—	—	—	—	—	—	—	—	18	100
Male	21	9	37	3	21	—	—	—	—	—	—	—	—	9	—	100
Chicken																
Female	—	9	—	55	—	9	—	—	—	—	—	—	—	—	27	100
Male	—	6	—	43	3	9	—	—	—	—	—	—	—	9	30	100
Fish																
Female	—	—	—	27	—	—	—	—	36	—	—	—	—	—	37	100
Male	—	3	—	21	—	—	—	—	36	—	—	—	—	3	37	100
Maíz																
Female	91	9	—	—	—	—	—	—	—	—	—	—	—	—	—	100
Male	49	9	3	—	6	—	—	—	—	—	—	—	—	12	21	100
Processed foods ^d																
Female	64	18	9	—	—	—	—	—	—	—	—	—	—	9	—	100
Male	21	24	34	3	15	—	—	—	—	—	—	—	—	3	—	100
Liquor																
Female	—	—	—	—	—	—	—	—	—	—	—	—	9	—	91	100
Male	—	—	—	—	—	—	—	—	—	—	—	—	6	—	94	100

^apulperia—corner grocery store.^bAlmacén—medium sized grocery store; usually better prices.^cFarmer's market—agricultural produce market held on fixed days of the week in different areas of the city.^dprocessed foods include coffee, sugar, cooking oil and shortening, salt, macaroni, canned foods, etc.

programs concern maternal and child health (Freer Miranda 1980). There is a children's library in the main plaza of San José and a fine children's hospital, as well as many other services for children.

Aside from these indications, I found the attitudes toward children in most homes to be those of patience and warmth. During the course of my observation I noted very little corporal punishment. In only one case was discipline carried out in this manner. In general, the behavior of children was controlled by diverting their attention or by removing them from the immediate area. In response to my questions mothers and caregivers told me that it was not customary to beat or spank children. This contrasted with what I had observed in the United States.

Family Interaction and Child Development

I spent time in each home observing the index child in the manner described previously. Generally, after the first few minutes the child ignored me and went on about his/her usual activities. In the physical environment I noted a lack of high chairs or raised stools or other equipment enabling the child to eat comfortably at the table. Children ate sitting on their mother's lap, sitting on a low chair reaching up to the table, standing on a chair, or sitting on top of the table or on the floor. Only 11 families, or 25%, of those observed had special furniture or made any provision for the child's comfort and ease while eating. Most children were encouraged to eat by themselves although some were completely fed and in the case of some a combination was employed—the child eating alone and then the mother helping to make sure that he/she had eaten enough. The lack of children's furniture

was probably the result of both tradition and low income. Locally made wooden chairs and other furniture pieces were available and were relatively inexpensive.

An analysis of variance obtained by use of the GLM procedure of the Statistical Analysis System showed some significant differences in certain activities observed in the home, based on the sex of the child. Girls were observed more frequently than boys playing by themselves ($F=4.71$, $p\leq 0.04$), playing with toys which stimulate fine motor development ($F=9.47$, $p\leq 0.004$), and engaging in imitative play, e.g. playing house, pretending to be an adult, etc. ($F=9.96$, $p\leq 0.003$). Boys were more frequently observed running ($F=4.44$, $p\leq 0.04$) and playing with toys which stimulate gross motor development ($F=8.43$, $p\leq 0.006$) than were girls. Mothers were observed stimulating language development with girls significantly more often than with boys ($F=6.64$, $p\leq 0.01$).

It is not surprising that boys were more often observed running than were girls. Soccer is the national sport, and one of the first skills a boy learns is to run and kick a ball. Girls in Costa Rica are expected to be homemakers; therefore, it is not unexpected to find them engaged in such activities as playing house or playing with dolls or other toys requiring the use of fine motor coordination and imagination. Also, some of the differences observed may result from the fact that boys between the ages of 1 and 2 years may be a little behind girls in their development. Observations at an older age might yield different results, because playing with some toys requires more coordination which boys may not develop until later. Distinguishing physiological causes from

culturally induced differences would require much more in-depth observation, however, and was not within the scope of this study.

Most children had access to toys and played with them, although the variety was not as great as in the United States. Most of the children customarily played with other children, usually brothers and sisters or cousins. Twenty-five percent of children were observed playing with an adult male at least once, usually another family member, i.e. father, older brother, or uncle. Forty-five percent of mothers were observed playing with the child. Although almost every family had a TV, very few of the children watched. Because electricity is expensive, the TV was usually turned on only at night and on special occasions when a number of adults were present. It was not at all unusual to find a family living in a shack but owning a television set.

Prior to beginning the research, I had been told by middle class Costa Rican informants that children of poor people were not at all stimulated and that it was common practice to leave babies in drawers or cribs without attention. I had also observed during my time in South America that, at least among the middle and upper classes, children were kept dependent for a much longer period of time than in the United States, probably because of the availability of servants. For example, they were fed rather than taught to eat with spoons. The children I observed in San José, however, were encouraged to be independent and to learn to take care of themselves. Although some children customarily drink a baby bottle of milk each night before bedtime until they are 5 or 6 years old, they still know how to drink from a glass and to eat using utensils. The baby bottle is a habit or treat. I also noted that the

index child received a good deal of physical and cognitive stimulation. Sixty-eight percent of the mothers were observed cuddling their child at least once during the visit. Forty-five percent were observed encouraging language development by talking with the child. Sixty-three percent of the children were observed conversing with other children or adults. In short, the majority of homes provided an environment that was full of potential stimuli, certainly not what could be called a severely deprived atmosphere.

Child Health

Based on my sample, I found children living in San José to have good access to primary health care through the community health program operating in each health center. As an indicator of the quality of health care, over 90% of the initial 107 children were found to have had their BCG, DPT, polio, and measles (rubella and rubeola) immunizations completed for their age. In comparison, records show that in Florida 93.7% of all school entrants had been immunized. This higher value, however, is undoubtedly influenced by the fact that obligatory immunization begins to function at school entrance age in Florida. Nationally, only 60% of the children aged 1-4 had been immunized. Although specific figures for children aged 1-4 or 1-3 were not available, the Florida State Health Plan indicated that immunization rates for this age group are considerably below that of school entrants, probably more in line with the national rate noted (Florida State Health Coordinating Council 1981). (Table 5 gives a breakdown of immunization figures for the group followed in depth.)

Nine percent of the children in the longitudinal study were observed to have dental caries upon a simple inspection. Other than this,

no clinical symptoms of malnutrition were observed. (Table 6 gives a breakdown for the group as a whole.)

Table 5. Immunization Rates for Costa Rican Children from Poor Urban Barrios

Type of immunization	Basic complete	Basic incomplete	No immunizations
	----- % -----		
BCG	95	—	5
DPT	93	7	—
Polio	98	2	—
Rubella	96	2	—
Rubeola	96	2	—

Note: Percentages are based on a sample of 44 children selected at random from health center birth registers.

Table 6. Clinical Symptoms of Malnutrition in a Sample Population of Children in San José

Symptom	Longitudinal study group (N=44)	Group excluded from longitudinal study (N=63)	Total group (N=107)
	----- % -----		
Dental caries	9	11 ^a	10
Apathy	—	2	1
Irritability	—	2	1
Lethargy	—	3	2
Dry hair	—	3	2
Scant hair	—	2	1
Diarrhea	—	3	2

^aMost of the symptoms other than dental caries were observed in two undernourished children eliminated from the study because of other problems complicating their nutritional status.

The mother is the person who usually cares for the child when he/she is ill, but grandmothers and aunts may also help. Fathers were never indicated as being directly involved in child care. Most of the families in the sample went to health centers, with a slightly smaller number going to social security clinics for medical care. Private physicians were used by a few and about 5% claimed to have no access to medical care. (See Table 7 for a breakdown of these figures.)

Diet and Food Habits as They Relate to Children

Although breast-feeding was once the norm in many developing countries, including Costa Rica, recent work has indicated that both the incidence and the duration of maternal lactation are declining (Jelliffe, E. F. P. 1979; Popkin et al. 1980). This trend was also noted in Costa Rica (Mata et al. 1981), and programs have been begun to encourage increased maternal lactation.

Data about maternal lactation were gathered on the 44 children in the longitudinal study. In an effort to compare these data with earlier information, Table 8 was constructed to show our results from 1982 as compared to results for Region I (Metropolitan San José) and the country as a whole in the national survey of 1975 (Díaz Amador 1975). This information appears to indicate a decline in numbers of children never breast-fed and a general trend toward longer periods of maternal lactation, although the percentage of children breast-fed more than one year is reported to be the same.

Table 9 shows comparative data regarding the age at which bottle feeding is begun and indicates a decline in babies never bottle fed and more bottle feeding started in the first month of life. However, a

Table 7. Who Cares for the Sick and What Facilities Are Used

	Longitudinal study group (N=44)	Group excluded from longitudinal study (N=63)	Total group (N=107)
	----- % -----		
	<u>Caretaker</u>		
Mother	82	86	84
Grandmother	9	1	5
Aunt	2	5	4
Mother and grandmother	5	5	4
Others	<u>2</u>	<u>3</u>	<u>3</u>
Total	100	100	100
	<u>Facility used</u>		
Health center	34	46	41
Social security (CCSS)	43	35	38
Private physician	7	5	6
Both health center and CCSS	5	5	5
None	7	3	4
Other	<u>4</u>	<u>6</u>	<u>6</u>
Total	100	100	100

Table 8. Comparative Data on Duration of Maternal Lactation

Length of time	1982 study	1975 Region I ^a	1975 total country ^b
	----- % -----		
Not breast-fed at all	9.1	16.0	13.3
Less than 1 month	6.8	12.2	13.3
1-3 months	25.0	30.2	20.3
4-6 months	13.6	3.7	4.3
7 months to 1 year	18.2	1.8	5.1
More than 1 year	27.3	27.4	34.1
Do not know	—	8.5	9.5

Note: Time periods given on the 1975 study have been combined so that they are equivalent to the time periods used in this study.

^aRegion I includes metropolitan San José.

^bDíaz Amador, 1975.

Table 9. Age at Which Bottle-Feeding Is Introduced Among Costa Rican Children—Comparative Data

Length of time	1982 study	Region I 1975 ^a	Total country 1975 ^b
	----- % -----		
Not breast-fed at all ^c	4.5	7.5	5.9
Less than 1 month	61.4	59.5	55.0
1-3 months	11.4	18.8	17.8
4-6 months	11.4	—	1.9
7 months to 1 year	6.8	2.8	3.1
More than one year	4.5	—	—
Do not know	—	8.5	16.1

^aRegion includes Metropolitan San José.

^bDíaz Amador, 1975.

^cTime periods have been combined in the 1975 study to make them equivalent to the time periods used in the current study.

large number of mothers are apparently introducing bottle feeding later as well. The changes shown in both Tables 8 and 9 may be the result of Ministry of Health-sponsored campaigns to promote breast-feeding. It is probably too soon, however, to say definitively that this is the case.

Data were also gathered about why mothers discontinued breast-feeding. Table 10 shows a summary of these data compared to reasons given in 1975. The basic reasons a mother decides not to breast-feed are insufficient milk supply and child rejection of breast-feeding.

My research also indicated that 23% of the mothers had introduced solid food within the first month of the child's life and by three months of age 77% of the infants had been introduced to regular food. By the end of the first 6 months, 93% of mothers had introduced their infants to regular food. In fact, looking at the incidence of breast-feeding without taking any of these other factors into account is misleading and can give a false impression. What actually happens is that most mothers are breast-feeding and bottle feeding simultaneously, starting when the infant is very young. Regular food is added as soon as the infant can tolerate it, beginning in the first month of life. Infants are first fed bits of food from the table and then gradually given their own portions.

Information about whether a child is being breast-fed is not as important as estimating the amount of breast milk received. The latter is difficult to do. There are mothers who report breast-feeding for 6 to 12 months, but after the first 2 or 3 months only once or twice a day; in this way breast-feeding only makes a small contribution to

Table 10. Reasons Given for Discontinuing Breast-Feeding—Comparative Data

Reason	1982 study	Region I 1975 ^a	Total country 1975 ^b
	-----	% -----	
Milk dried up or did not have sufficient supply	41.2	46.8	42.4
Child rejected breast-feeding	14.7	15.6	14.5
Mother pregnant	11.8	—	—
Mother's illness	8.8	6.5	6.8
Mother's work	5.9	7.8	5.1
Physician's orders	5.9	1.3	2.9
Child biting	5.9	5.2	—
Child hospitalized	2.9	—	2.3
Child ill at home	2.9	—	0.6
Advice from friends and relatives	—	—	1.0
Believe cow's milk is better	—	—	0.6
Other	—	16.9	23.8

^aRegion I includes Metropolitan San José.^bDíaz Amador, 1975.

the child's diet. The scope of this study did not include estimating the amount of breast milk received by the child.

Other information from 24-hour recalls for the index child show two facts of special interest. First, milk, whether breast or bottle, is the primary source of protein for the child under 3 years of age. The second item of interest is that, although rice and beans are staples of the Costan Rican diet and good sources of protein, the child under 3 years of age is by tradition fed rice and caldo de frijol, or the juice in which the beans have been cooked. Although caldo de frijol is a relatively good food from a nutrition point of view, it is not equivalent in protein to the whole bean. Government policies which seek to decrease milk available to small children from poor families and substitute rice and beans could be detrimental for children under 3 years of age.

A brief discussion on some of the more pertinent social and cultural factors which may have important influences on the nutritional status of the urban poor child in San José, Costa Rica, has been presented. The next chapter will deal with the actual comparison in growth and development between children of low weight/length and those of normal weight/length.

CHAPTER V RESULTS

Anthropometric Data

A total of 107 children, 54 males and 53 females, born in 1980 were chosen at random from birth registers in low income areas associated with the health centers of Alajuelita, Hatillo, Pavas, Tibas, Paso Ancho, Guadalupe, and Cristo Rey. In the initial survey, measurements of length, weight, head circumference, arm circumference, triceps, and subscapular skinfolds were taken. In addition to these measurements, the Denver Developmental Screening Test (DDST) was given to each child and a family registry and assessment of the environment were done. Table 11 shows the distribution of the children surveyed with respect

Table 11. Distribution of Weight/Length Percentile Rankings by Sex of the Initial Sample of 107 Children from Poor Urban Households in San José, Costa Rica

Sex	Percentile				
	<5th	5th-10th	>10th-25th	>25th-50th	>50th
Male	5	5	7	14	16
Female	3	3	8	19	18
Total	8	8	15	33	43
Percent	7.5	7.5	14	31	40

Note: Percentiles are based on NCHS standards (National Center for Health Statistics 1977).

to percentile rankings. As indicated, only 7.5% ($n=8$) of the children were found to be below the 5th percentile. Another 7.5% ($n=8$) fell between the 5th and 10th percentiles. These findings indicate a low percentage of severely undernourished children. It was decided therefore to focus on the moderately undernourished child. The ministry of Health criterion of 90% of the median of National Center for Health Statistics (NCHS) weight/height standards and/or first degree malnutrition by Gomez's criterion was used to delineate a group of mildly underweight children to be followed and compared with normal weight/length children. These criteria were used even though they included more children in the low weight/length group than would occur by use of the 5th percentile category. This was felt to be a reasonable division given the fact that less is known about problems involving invisible or mild undernutrition in children, particularly the boundaries which define it.

The families of 19 of the children in the low-weight/length group agreed to let them participate. Twenty-five normal weight/length children were chosen at random and also were asked to participate. Although the drawing was done randomly, more girls than boys of both the low weight/length and the normal group were not allowed to participate. In the case of the 25 normal weight children, substitutions were made by drawing another random number. The result was 18 females and 26 males in the final study, even though the initial group was evenly divided.

After the group for the longitudinal study was selected, six additional monthly measurements of length, weight, head circumference, and arm circumference were taken. Triceps and subscapular skinfold measurements were taken at the beginning and at the end of the 6-month

longitudinal study. For the purposes of this particular study, only the weight/length figures are analyzed. Table 12 shows the distribution of the smaller group of 44 children with respect to percentile distribution of the initial and final measurements.

Table 12. Distribution of Weight/Length Percentile Rankings of Initial and Final Measurements by Sex in a Sample of 44 Children from Poor Urban Households in San José, Costa Rica, Who Were Followed for 7 Months

Sex	Percentile				
	<5th	5th-10th	>10th-25th	>25th-50th	>50th
<u>Initial measurement</u>					
Male	3	5	3	8	7
Female	1	3	5	7	2
Total	4	8	8	15	9
Percent	9	18	18	31	21
<u>Final measurement</u>					
Male	3	5	6	5	7
Female	2	—	7	5	4
Total	5	5	13	10	11
Percent	11	11	30	23	25

Note: Percentiles are based on NCHS (National Center for Health Statistics 1977).

Growth Patterns

As Table 12 indicates, there was some shifting in the percentile rankings over time. Although there was a slight increase in the percentage of children under the 5th percentile at the end of the study,

there was also a decrease in children in the 5th-10th percentile category and an increase in the number of children in the 10th-25th and 50th percentile categories. The overall impression is that growth shows a great deal of individual variation and tends to occur as a series of mini-catch-up spurts for both height and weight. Specific illness episodes or other events (e.g. weaning) only partially explain the observed variation in growth magnitude and velocity. Figure 6 illustrates this pattern well. The child is a female of normal weight/length with no reported illnesses or unusual family circumstances, but whose growth velocity varies a great deal from month to month. Figure 7 illustrates the classic pattern of the mother becoming pregnant and weaning the child. The child, a male, was normal in weight/length but dropped 0.5 kg. (4% of body weight) during the adjustment period. In this case the child suffered no severe effects because he had reserved body fat. The underweight child in this same situation would not be so fortunate. Figure 8 illustrates another typical problem related to growth. The child, a male of normal weight/length, was cared for by the grandmother while his mother worked. The grandmother went to work, leaving a rather emotionally unstable aunt in charge of the children. The index child of this family lost weight (1.5 kg., 13% of body weight) rather abruptly and did not begin to regain it until the grandmother returned to stay with the children.

These examples have been chosen as representative of typical growth patterns found among the children followed and as such demonstrate the need for many measurements over time in order to determine the state of a child's health and nutritional status. Cross-sectional studies do not necessarily reveal this individual variation.

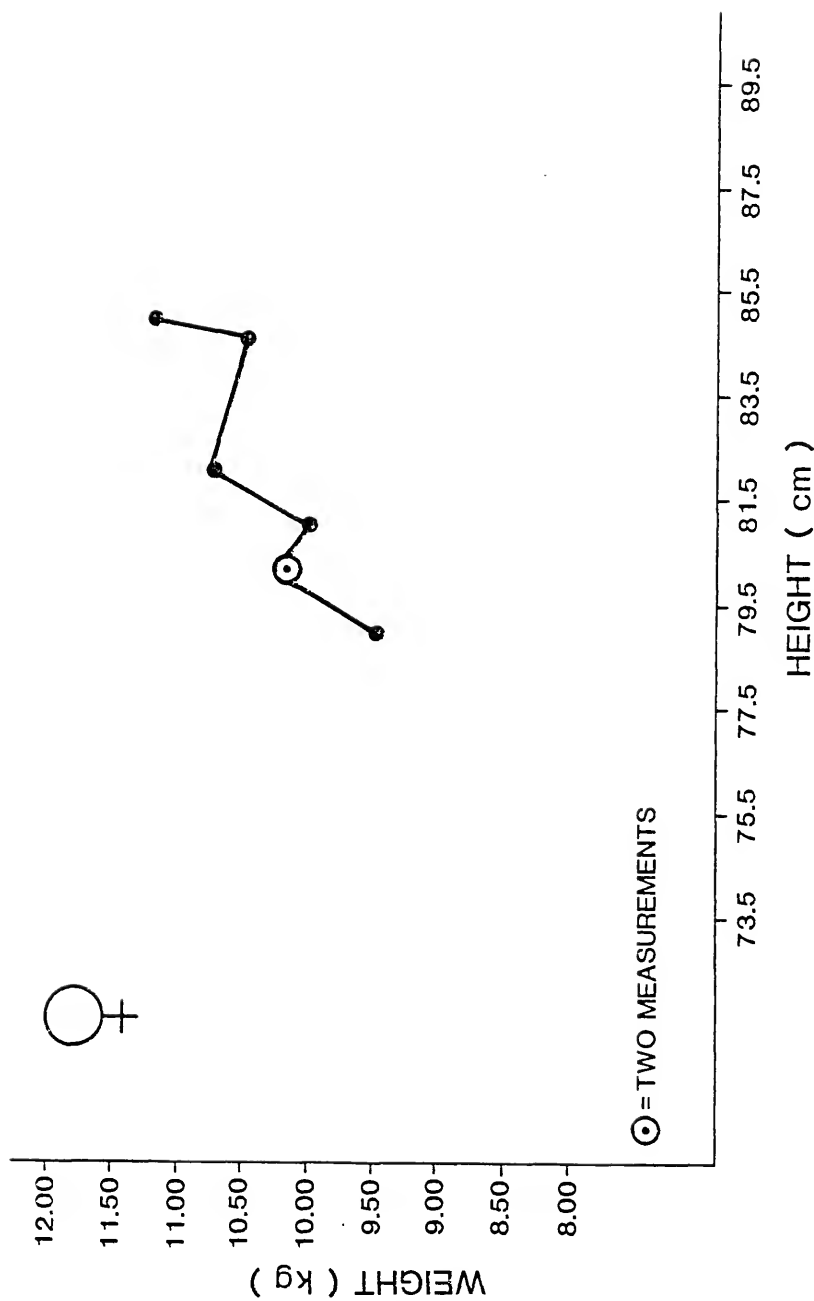


Figure 6. Variations in Growth Velocity in a Female of Normal Weight/Length with No Reported Illness.

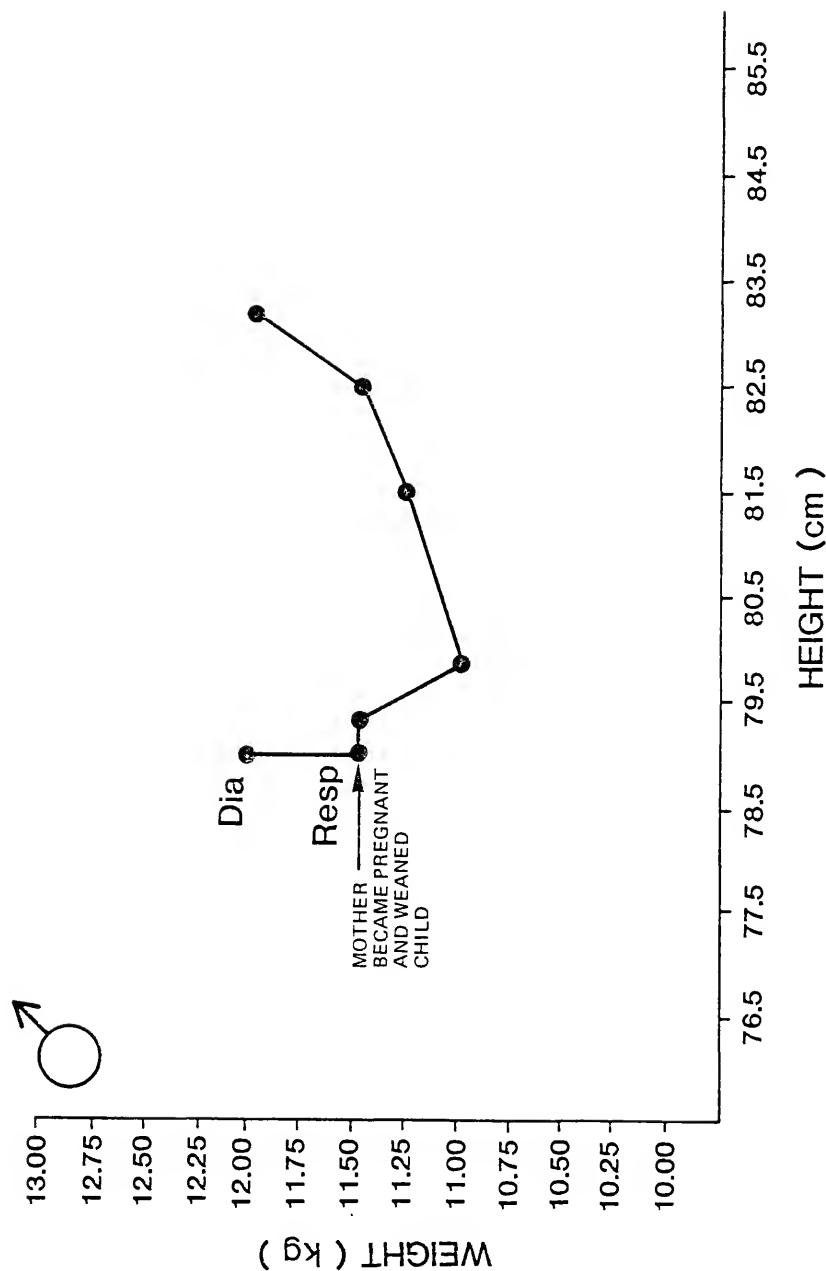


Figure 7. Male, Normal Weight/Length. Dia = Diarrheal Illness Reported; Resp = Respiratory Illness Reported.

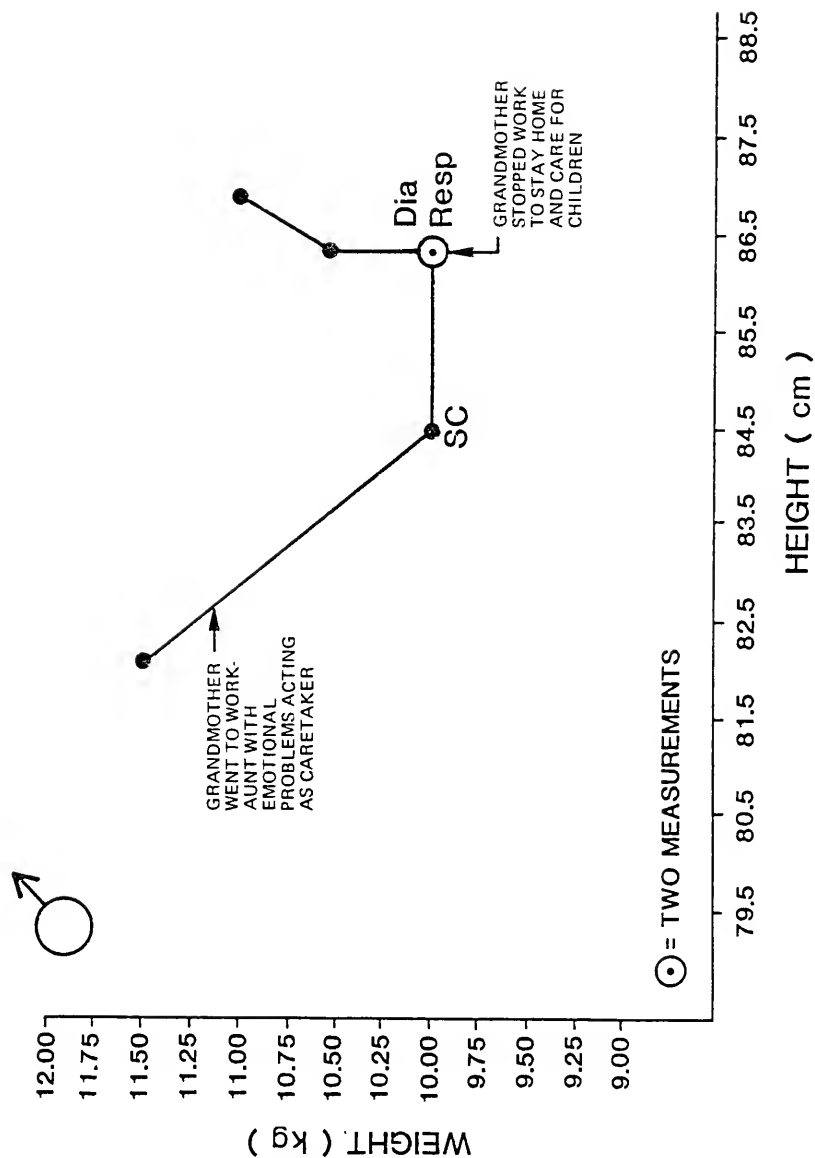


Figure 8. Male, Normal Weight/Length, Showing "Grandmother Effect." Dia = Diarrheal Illness Reported; Resp = Respiratory Illness Reported; SC = Selected Common Symptoms Reported.

Maternal Reproductive History and Birth Weights

A SAS general linear model (GLM) analysis of variance showed that no significant differences existed between mothers of low weight/length children with respect to total number of pregnancies, age, the order of the index child in terms of total pregnancies, or the order of the index child in relation to living children.

Birth weight was found to be lower among the low weight/length group as compared to the normal weight/length group ($F=5.94$, $p \leq 0.02$). Because of the large number of boys in the group, particularly the normal group, analyses were also done by sex. Low weight/length boys were found to have significantly lower birth weights than normal weight/length boys ($F=4.64$, $p \leq 0.04$). Low weight/length girls, however, were not found to differ significantly from normal weight girls with respect to birth weight, even though their average birth weight was lower (2818 grams as compared to 3060 grams). In this study birth weight was not controlled but rather was one of the parameters allowed to vary. In an effort to determine to what extent birth weight was influenced by genetic factors, the height and weight of each child's mother were also obtained. An analysis of variance indicated no significant difference between the height and weight of the mothers of low weight/length children and those of the mothers of the normal children. In the former group both weight and height tended to be lower but not significantly so. This suggests that the low birth weight associated with the mildly underweight child may be more related to maternal undernutrition during pregnancy than to other factors.

Illness Classification

In addition to the health history obtained initially for the year prior to the beginning of the study, health histories were elicited monthly from primary caretakers. An illness classification was developed based on the work of Martorell and Yarborough (1983). Diarrheal illnesses include diarrhea and gastroenteritis, including pega. Respiratory illnesses include bronchitis, cough, cold, asthma, flu, and gripe. Selected common symptoms include all of the above diseases and symptoms plus fever, vomiting, skin infections, tonsilitis, parasites, inflammations, ear infections, allergy, kidney or bladder infection, loss of appetite, and dyhydration.

There were not significant sex differences in the average number of illnesses, although males had more diarrheal illnesses and illnesses included in the selected common symptoms category. Slightly more females were, on the average, reported as having respiratory illnesses. A large number of children (23, or 52%) were reported as having no diarrheal illnesses.

A total of 160 illnesses, including 74 respiratory illnesses and 30 diarrheal illnesses, were recorded for the sample over a consecutive 7-month period (Table 13); 50% of the illnesses occurred during the rainy season and 50% during the dry season. There was no significant difference in the occurrence of respiratory illnesses by season. Diarrheal illnesses showed a significant seasonal trend with a mean of $\bar{X} = 3.00$ cases in the dry season and $\bar{X} = 6.00$ cases in the rainy season ($t=2.60$, $p \leq 0.05$). Select common symptoms showed no significant

seasonal variation with means of $\bar{X} = 20.00$ and $\bar{X} = 26.67$ for the dry season and rainy season respectively ($t=0.544$ N.S.). The mean number of illnesses per child was $\bar{X} = 3.64$.

Table 13. Seasonal Frequencies of Illness Among Low-Income Urban Children in San José, Costa Rica

Month and season	Diarrheal	Respiratory	Selected common symptoms
Month 1 Dry	1	6	7
Month 2 Dry	5	12	24
Month 3 Dry	1	15	26
Month 4 Dry	5	8	23
Month 5 Rainy	7	6	22
Month 6 Rainy	7	13	33
Month 7 Rainy	<u>4</u>	<u>14</u>	<u>25</u>
Total	30	74	160

With respect to elicited health histories for the year prior to the initiation of the study, significantly more children in the low weight/length group were reported as having fever ($\chi^2=4.62$, $p \leq 0.03$) than in the normal weight/length group. Other than this there was no appreciable difference between the two groups in the reported incidence

of illness according to the health histories. Table 14 gives a summary of the illness episodes reported in the histories.

Psychomotor Development

Table 15 gives a summary of the group as a whole with respect to the results of the Denver Development Screening Test (DDST). Twelve percent ($n=8$) of the normal weight/length group and 17% ($n=4$) of the low weight/length group had abnormal or questionable results on the DDST. It is suggested that a more discriminating instrument may be necessary to detect differences between mildly underweight children and normal weight children. However, more interesting is the fact that 50% ($n=5$) of the children who were short for their age but normal in weight/length had abnormal or questionable results on the DDST. Unfortunately, these children, because they were considered normal in weight/length and because they represented a different nutritional problem, were not included in the in-depth study. These results suggest that an additional follow-up of short-for-age children may be warranted, even though they may not be technically considered undernourished by weight/length criteria.

Socioeconomic Factors

There were slightly more ($\bar{X}=2.5$) children under 6 per household in the low weight/length group than in the normal group ($\bar{X}=2.0$); this difference, however, was not statistically significant (see Table 16). Household size tended to be larger, mother and father older, household income less, and education of both mother and father less in the low weight/length group. Total household income was calculated by summing

Table 14. Number of Illnesses Reported as Occurring During the Previous Year in a Sample of Children 1 to 3 Years of Age from Poor Urban Barrios in San José, Costa Rica (N=44)

	Number of Illness Episodes							Number of children with chronic illnesses	Number of children with no illnesses
	1	2	3	4	5	6	7		
Diarrhea	9	4	2	1	2	2	-	1	23
Vomiting	5	5	1	-	1	1	-	-	31
Parasites	2	-	-	-	-	-	-	-	42
Fever	11	9	3	2	-	3	1	3	12
Cough	7	4	8	5	4	4	2	3	7
Flu	3	4	6	6	2	4	1	1	17
Cold	9	3	8	6	4	4	1	3	6
Allergy	13	-	-	1	-	-	-	6	24
Loss of appetite	9	1	4	2	-	1	-	4	23
Dermatitis	6	-	-	-	-	-	-	-	38
Rubella	2	-	-	-	-	-	-	-	42
Rubeola	-	-	-	-	-	-	-	-	44
Mumps	-	-	-	-	-	-	-	-	44
Chickenpox	2	-	-	-	-	-	-	-	42
Stomatitis	2	2	-	-	-	-	-	-	40
Hepatitis	-	-	-	-	-	-	-	-	44
Accidents	3	-	-	-	-	-	-	-	41
Other illnesses	4	3	2	2	2	-	-	-	31
Hospitalization	3	-	-	-	-	-	-	-	41

Table 15. Results of the Denver Developmental Screening Test According to Weight/Length Categories in a Sample of Poor Urban Children in San José, Costa Rica (N=107)

DDST score	Normal weight/length		Low weight/length		Over weight/length		Short length/age		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Normal Male	31	47	9	39	3	37	2	20	45	42
Female	<u>27</u>	<u>41</u>	<u>9</u>	<u>39</u>	<u>5</u>	<u>63</u>	<u>3</u>	<u>30</u>	<u>44</u>	<u>44</u>
Total	58	88	18	78	8	100	5	50	89	83
Questionable or abnormal										
Male	4	6	3	13	—	—	2	20	9	8
Female	<u>4</u>	<u>6</u>	<u>1</u>	<u>4</u>	<u>—</u>	<u>—</u>	<u>3</u>	<u>30</u>	<u>8</u>	<u>8</u>
Total	8	12	4	17	—	—	5	50	17	16
Impossible to evaluate ^a										
Male	—	—	—	—	—	—	—	—	—	—
Female	<u>—</u>	<u>—</u>	<u>1</u>	<u>5</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>1</u>	<u>1</u>
Total	—	—	1	5	—	—	—	—	1	1
Total	66	100	23	100	8	100	10	100	107	100

^aIn this case it was impossible to score the test because the subject refused to perform the tasks.

all salaries of family members plus the value of food or other items which were gifts, and any other support, i.e. government aid. Since this information was collected after about 5 months of visits, it is felt to be a reasonably accurate estimate. The exchange rate from colones to dollars was calculated at 45/1 which was approximately what it was when the questionnaires were answered.

Table 16. Means of Selected Social Characteristics of the Families of Low and Normal Weight/Length Poor Children in San José, Costa Rica

Characteristic	Low weight/length (n=19)	Normal weight/length (n=25)
Household size	6.6	6.2
Children 6 and under	2.5	2.0
Father's age	32.4	31.1
Father's education (no. of years completed)	6.5	7.0
Mother's age	28.2	25.3
Mother's education (no. of years completed)	6.3	7.0
Total household income per month	₡4505 (\$100)	₡4872 (\$108)
Total food cost per month	₡3991 (\$89)	₡3761 (\$84)

The cost of food was calculated on a per month basis according to the frequency of purchase of food items as reported to the investigators. The prices were as accurate as possible given the frequent fluctuations caused by inflation during 1982. A greater proportion of income was spent on food in the households of the low weight/length group (89%) than in the households of the normal group (77%).

Fifty-three percent of the families of the low weight/length group and 36% of those of the normal weight/length group either owned or were buying their homes. Table 17 gives a summary of the type of tenure of the dwelling. More families among the normal weight/length group were renting, and fewer owned their own homes.

Table 17. Type of Tenure of Dwelling in a Sample of Low Weight/Length and Normal Weight/Length Children from Low Income Families in San José, Costa Rica

Type of Tenure	Low weight/length (n=19)	Normal weight/length (n=25)
Own home	32	16
Buying home	21	20
Rent home	42	52
Borrowed home ^a	<u>5</u>	<u>12</u>
Total	100	100

^aIn this case families were usually living in a house belonging to some other family member, i.e. mother, father. Rent was paid when funds were available.

More of the parents of children in the low weight/length group were married than in the normal weight/length group (68% as compared to 56%). Forty percent of the parents of the normal weight/length group and 16% of the parents of the low weight/length group were single. Thirty-two percent of the households of the normal weight/length group were female headed, whereas 16% of the households in the low weight/length group were of this type.

The sample was slightly biased toward families with a more stable residence because of the method of selection. Those who had moved within the previous year were not usually included in the birth registers we used to select the sample. Eighty-four percent of the families of children in the low weight/length group and 72% of those of children in the normal weight/length group had lived in their present residence for three years or more. Fifty-eight percent of the families of the low weight/length group and 56% of the families of the normal weight/length group had lived 5 or more years at the same residence.

Thirty-eight percent of the fathers of the low-weight/length group and 11% of the fathers of the normal weight/length group were unemployed or worked only occasionally or seasonally. Seventy-nine percent of the mothers of the low weight/length group and 67% of those of the normal weight/length group did not work outside the home. Thus, not only was employment less for men but also for women in the families of the low weight/length group.

Data collected about buying patterns indicated that most families did not buy on time; however, more of the families of the low weight/length group did—32% compared to 12% of the normal weight/length

group. Thirty-two percent of the families of the normal weight/length group also reported having some savings as compared to 5% of the families of the low weight/length group.

With respect to environmental conditions, wooden houses predominated in both groups (58% and 64% in the low and normal groups respectively). A few were made of brick or cement block (42% and 32% respectively) (see Table 18). Most had cement floors and zinc roofs. Condition of housing was generally good. Approximately 26% of the families of low weight/length children and 24% of the families of normal weight/length children lived in government housing projects. The houses had 1 to 5 rooms with an average number of 2 rooms in both groups. The number of beds per family ranged from 1 to 6, with a mean of 3.5 beds per household.

Most families in both groups cooked with electricity although gas wood and/or charcoal, and kerosene were also used by a small number (25%). During the course of the study a number of people began to use wood and/or charcoal again because the cost of electricity had risen as a result of inflation and the increased cost of importing petroleum to Costa Rica. A total of 15% of the families of the low weight/length group and 24% of the families of the normal weight/length group were either using charcoal exclusively or a combination of charcoal and electricity and/or gas. Charcoal and wood are local products and relatively cheap. When a combination of cooking methods was used, usually for items requiring long cooking periods such as beans, rice, soups, and stews, charcoal was used, whereas the electric stove or hot plate was used for foods which could be cooked rapidly, i.e. eggs,

Table 18. A Comparison of Environmental Conditions in a Sample of Low Weight/Length and Normal Weight/Length Children from Low Income Families in San José, Costa Rica

Item	Low weight/length (N=19)	Normal weight/length (N=25)
	-----	-----
Construction of walls		
Brick or cement block	42	32
Wood	58	64
Zinc	—	4
Condition of walls		
Good	95	92
Peeling paint	—	4
Holes in wall	—	4
Peeling paint and holes in wall	5	—
Construction of floor		
Cement	47	48
Wood	53	52
Condition of floor		
Good-clean	95	80
Good-dirty	5	8
Fair-clean	—	12
Poor	—	—
Construction of roof		
Tile	5	4
Zinc	90	92
Siding	5	4
Condition of roof		
Good (no leaks)	100	96
Bad (leaks)	—	4
Ventilation		
Good	90	96
Poor	10	4
Number of rooms		
1	26 (x=2.3)	24 (x=
2	42	40 2.2)
3	16	24
4	10	12
5	5	—

Table 18—(continued)

Item	Low weight/length (N=19)	Normal weight/length (N=25)
Number of beds		
1	— (x=3.7)	4 (x=3.6)
2	21	20
3	21	28
4	37	24
5	5	4
6	16	20
Number of persons per bed		
1	74	60
2	21	24
3	5	16
Type of stove		
Gas	11	8
Wood/charcoal	5	20
Kerosene	5	—
Electric	69	68
Both charcoal/wood and electric	5	4
Both charcoal/wood and gas	5	—
Condition of stove		
Good	95	96
Fair	5	4
Poor	—	—
Type of lighting		
Electric	100	100
Type of disposal of excreta		
Sewer	42	36
Septic tank	53	36
Latrine	5	24
Regular water drainage area	—	4

Table 18—(continued)

Item	Low weight/length (N=19)	Normal weight/length (N=25)
Condition of sanitary facilities		
One family, good condition, clean	84	56
One family, good condition, dirty	—	4
One family, poor condition, clear	—	12
Multifamily, good condition, clean	16	16
Multifamily, poor condition, clean	—	12
Bathing facilities (shower)		
One family	84	88
Multifamily	16	12
Water supply		
City line in house	100	100
Pets		
Yes	53	36
No	47	64
Other animals		
None	100	92
Cow	—	4
Chickens	—	4
Radio		
Yes	95	92
No	5	8
Television		
Yes	95	88
No	5	12
Stereo		
Yes	47	24
No	53	76

Table 18—(continued)

Item	Low weight/length (N=19)	Normal weight/length (N=25)
Refrigerator		
Yes	47	56
No	53	44
Blender		
Yes	63	56
No	37	44
Tape recorder		
Yes	37	32
No	63	68
Sewing machine		
Yes	32	44
No	68	56
Percolater		
Yes	26	24
No	74	76
Toaster		
Yes	11	4
No	89	96
Wafflemaker		
Yes	—	4
No	100	96

meats, macaroni, or spaghetti. The combination of cooking methods is an example of the adaptive measures families were using to survive the economic crisis.

Service by the city of San José was seen to deteriorate in poor neighborhoods as compared to other areas of the city with respect to sewage disposal, garbage collection, and other sanitation measures. It was frequently possible to see open ditches with sewage or drainage areas in the community and in individual houses. Both groups were

affected by these conditions, although environmental conditions among the families of the normal weight/length group tended to be slightly worse. However, most of the families with very bad environmental conditions had healthy children who seemed to thrive regardless of their surroundings. This is probably the result of the excellent program of health and nutrition intervention already mentioned.

All the families had pets, but more of the families of the low weight/length group had pets than did families of the normal weight/length group. Domestic animals such as cows and chickens were encountered among a small percentage of the families of the normal weight/length group. The animals in these cases were used to supplement the diet of the family. Only those families living on the periphery of the city were able to maintain animals. Most families had no place for animals or gardens. Three of the families of low weight/length children and three of the families of normal weight/length children had gardens which regularly produced food for consumption.

Ninety-five percent of the households of the low-weight/length group and 88% of the households of the normal weight/length group had televisions. Over 90% had radios. More households of the normal weight/length group had refrigerators than did households of the low weight/length group—56% compared to 47%. Slightly more households of the low weight/length group had stereos, tape recorders, blenders, and toasters than did the households of the normal weight/length group. Often these were given as gifts in a grand gesture. Most of these appliances had been purchased prior to the beginning of the economic crisis of 1981-82.

Dietary Data

Food Frequency

The food frequency data obtained by using the Q-sort indicated that the basic daily diet among families of both groups included beans, rice, bread, banana, white sugar, coffee, butter or margarine, milk, tomato, onion, and sweet pepper (the latter three used as condiments in cooking other dishes) (see Table 19). In addition to these items, tubers such as manioc, potatoes, and spaghetti or macaroni were eaten at least two or three times per week. Cabbage salad, carrots, lettuce salad, and oranges were also commonly eaten at least two or three times per week. Meat was used as a flavoring in cooking soups and stews and other primarily vegetable dishes. Beef in the form of hamburger, stew meat, or steak was the most common meat eaten; however, processed luncheon meat was the single most frequently consumed meat item—43% ate it daily or 2-3 times per week. Chicken and pork were eaten about once a week or once every 2 weeks or less frequently. Fish was eaten monthly or seasonally by most families.

A Wilcoxon 2-sample test (t test approximation) and a Kruskal-Wallis test (chi square approximation) were run on the food frequency data comparing the consumption of the families of the low weight/length group with the families of the normal weight/length group. The results were significant only for the frequency of consumption of liver, mustard greens, and oranges. The families of the normal weight/length group reported consuming significantly more of these items ($\chi^2=7.04$, $p \leq 0.008$; $\chi^2=4.07$, $p \leq 0.04$; $\chi^2=4.32$, $p \leq 0.04$ respectively). Because all of these are relatively inexpensive items which are readily available,

Table 19. Selected Foods Commonly Eaten by a Sample of Poor Urban Families in San José, Costa Rica (N=44)

Food	Frequency						Total
	Daily	2-3 times per week	Weekly	Biweekly	Monthly	Seasonally	
Milk	89	5	4	—	—	2	100
Tomato	84	9	5	—	—	2	100
Onion	91	—	2	5	—	—	100
Beans	86	7	7	—	—	—	100
Bread	86	9	3	—	—	2	100
Rice	98	—	2	—	—	—	100
Banana	75	16	7	—	—	—	100
White sugar	96	2	—	—	—	—	100
Butter/ margarine	89	5	2	2	—	2	100
Sweet pepper	68	5	11	2	2	5	100
Spaghetti	21	52	18	5	2	—	100
Tortilla	46	16	18	2	2	11	100
Coffee	93	3	—	—	2	—	100
Cabbage salad	48	30	9	4	—	5	100
Egg	43	20	23	7	5	2	100
Tubers	41	20	18	5	5	9	100
Carrots	27	30	18	11	2	5	100
Ripe plantain	34	36	9	12	2	5	100
Lettuce salad	23	39	20	7	2	2	100
Cookies	36	23	18	—	9	7	100
Sweetbread	37	25	11	7	2	7	100

Table 19—(continued)

	Frequency						Total
	Daily	2-3 times per week	Weekly	Biweekly	Monthly	Seasonally	
Potatoes	14	39	30	9	4	—	100
Orange ^a	39	27	9	9	5	11	100
Celery	46	18	14	11	—	—	100
Mustard	—	—	—	—	—	—	100
greens ^a	—	9	7	7	9	27	100
Beefsteak	11	27	25	16	2	5	100
Vegetable	5	9	25	18	11	14	100
beef stew	2	12	12	11	34	18	100
Fish	—	—	—	—	—	—	100
Luncheon	20	23	18	14	11	7	100
meat	11	18	25	21	9	9	100
Hamburger	2	14	18	25	21	11	100
Liver ^a	2	5	2	5	2	43	100
Weiner	2	12	25	16	16	18	100
Chicken	2	9	23	5	16	11	100
Pork	—	5	9	14	27	27	100
Tuna	—	—	—	—	—	—	100
Tapa dulce	11	7	23	14	9	20	100
(cane sugar)	14	9	18	7	11	32	100
Sweet lemon	7	30	21	11	11	11	100
Green beans	21	20	16	7	9	20	100
Papaya	2	—	7	—	5	20	100
Beer	2	2	5	—	5	66	100
Liquor	11	39	32	9	2	18	100
Chayote	—	—	—	—	—	5	100

^a Foods which the normal weight/length group ate significantly more of than did the low weight/length group.

this finding may represent an adaptive strategy used by the families of the normal weight/length group to enhance their diet.

Breast-Feeding Patterns

Table 20 compares data representing the breast-feeding history of low and normal weight/length children. More of the normal weight/length children had never been breast-fed; however, there was a slight tendency toward longer duration of breast-feeding among low weight/length children. Sixty-eight percent of low weight/length children and 52% of normal weight/length children were breast-fed 4 months or more. The low weight/length group also tended to have been introduced to bottle feeding and regular foods later. Approximately 31% of the low weight/length group and 16% of the normal weight/length group were not introduced to bottle feeding until the age of 4 months or more. Thirty-seven percent of the low weight/length group and 12% of the normal weight/length group were not introduced to regular food until age 4 months or more. A Wilcoxon 2-sample test (\underline{t} test approximation) showed no significant differences between the two groups.

Attitudes About Food

Table 21 shows a summary of the most liked/least liked, most nutritious/least nutritious food Q-sort. In general, the subjects regarded the foods they liked most as being less nutritious (beans, rice, beef stew, ice cream). Foods which were regarded as highly nutritious were invariably placed much lower on the most liked-least liked scale (liver, spinach, red beets, and fish). The overall impression is that subjects tended to consider foods eaten every day as being less

Table 20. A Comparison of the Breast-Feeding History of Low Weight/Length (N=19) and Normal Weight/Length (N=25) Children in San José, Costa Rica

Age/duration	Duration of breast-feeding				Age at which bottle feeding was begun				Age at which regular food was introduced			
	Low		Normal		Low		Normal		Low		Normal	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Never	1	5	3	12	2	11	—	—	—	—	—	—
Less than 1 month	2	11	1	4	10	53	17	68	5	26	5	20
1-3 months	3	16	8	32	1	5	4	16	7	37	17	68
4-6 months	4	21	2	8	2	11	3	12	5	26	2	8
7 months to 1 year	2	10	6	24	2	10	1	4	2	11	1	4
More than 1 year	7	37	5	20	2	10	—	—	—	—	—	—
Total	19	100	25	100	19	100	25	100	19	100	25	100

Table 21. A Comparison of Selected Foods Considered Most and Least Nutritious and Those Most and Least Liked

Food	Most nutritious/ liked			0	Least nutritious/ liked		
	+3	+2	+1		-1	-2	-3
	-----			%	-----		
Beans	68 ^a	18	9	2	3	—	—
	73 ^b	12	9	2	2	—	2
Tortilla	52	25	14	2	—	5	2
	66	16	11	—	—	5	2
Rice	73	23	4	—	—	—	—
	82	5	9	—	2	—	2
Ripe plantain	61	25	9	5	—	—	—
	68	23	5	2	—	—	2
Yam	71	20	5	2	—	2	—
	50	25	16	2	—	—	7
Tubers	84	16	—	—	—	—	—
	75	14	5	2	—	2	2
Potato	59	27	9	—	2	3	—
	75	18	2	2	2	3	—
Papaya	68	18	7	—	5	2	—
	66	16	14	2	—	—	2
Liver	96	2	—	2	—	—	—
	75	14	7	—	2	—	2
Chicken	89	11	—	—	—	—	—
	80	7	5	4	2	—	2
Milk	89	11	—	—	—	—	—
	86	7	2	—	—	—	5
Tomato	62	23	11	2	2	—	—
	73	16	9	—	—	—	2
Lettuce	71	12	11	—	2	2	2
	75	16	7	—	—	2	—
Hamburger	71	25	—	2	—	2	—
	71	14	11	—	2	—	2

Table 21—(continued)

Food	Most nutritious/ liked		+1	0	-1	-2	Least nutritious/ liked	
	+3	+2					-3	
	-----			%		-----		
Pork	77	11	7	2	—	—	2	
	68	14	9	2	5	—	2	
White sugar	34	14	27	11	4	5	5	
	41	34	16	2	—	5	2	
Ice cream	48	27	9	7	—	2	7	
	68	5	9	16	—	2	—	
Egg	80	16	2	—	2	—	—	
	75	14	5	4	—	—	2	
Spinach	80	14	2	4	—	—	—	
	43	23	16	—	—	7	11	
Banana	61	20	9	2	6	—	2	
	64	14	11	—	7	—	4	
Carrot	77	11	5	5	—	—	2	
	46	27	14	4	—	—	9	
Red beets	75	9	7	4	5	—	—	
	52	21	18	—	5	2	2	
Fish	90	7	—	2	—	—	—	
	61	16	14	2	—	2	5	
Beef steak	95	5	—	—	—	—	—	
	84	5	5	2	2	—	2	
Beef stew	93	7	—	—	—	—	—	
	80	18	—	—	—	—	2	
Orange juice	77	14	2	—	5	2	—	
	57	23	7	2	7	2	2	
Orange	73	18	5	—	2	—	2	
	66	23	5	4	2	—	—	
Gerber cereal	73	11	5	4	5	—	2	
	64	18	11	2	—	5	—	

Table 21—(continued)

Food	Most nutritious/ liked			0	Least nutritious/ liked		
	+3	+2	+1		-1	-2	-3
	-----			%	-----		
Bread	48	32	16	2	—	2	—
	73	20	2	—	2	—	2
White cheese	68	21	7	—	—	2	2
	71	18	2	5	2	—	2
Coffee	9	7	18	18	16	5	27
	55	14	18	7	—	—	7
Coke	4	9	18	25	7	14	23
	43	18	14	9	2	5	9
Spaghetti	59	23	11	5	2	—	—
	82	16	—	—	—	—	2
Bear	2	5	9	20	7	9	48
	7	11	—	29	7	7	39

^aMost nutritious—least nutritious.^bMost liked—least liked.

nutritious than some more exotic foods which perhaps have received more attention from nutrition education programs, e.g. liver, spinach, fish, orange juice, and carrots).

The Q-sort of foods considered appropriate for the index child showed that mothers of both groups were unanimous in considering as proper foods ripe plantain, tubers (manioc, etc.), liver, chicken, milk, egg, banana, carrot, vegetable beef stew, orange juice, oranges, and soup. The groups disagreed about such foods as green mango, watercress, sausage, lunchmeat, peas, corn, corn flakes, and canned tuna. More of the mothers of the low weight/length group thought these latter foods were appropriate than did the mothers of the normal weight/length group (see Appendix 11). Almost all mothers agreed that liquor, beer, coffee, and coke were not good for children. A chi square test of independence was run on those food items which seemed to show the most variation between groups. Luncheon meat and watermelon were the only two which showed a significant result ($\chi^2=4.02$, $p \leq 0.05$ and $\chi^2=4.48$, $p \leq 0.03$ respectively). Because of the distribution, over 20% of the cells had counts of less than 5; therefore chi square was not considered valid. A Fisher's exact test was run on the same items. None of the results were significant. Thus, it was concluded that, although there were some differences between the groups, they were not great enough to warrant further consideration.

In-Home Observation of the Index Child

In-home observation was carried out to learn something about child-rearing practices and the general environment of the home in which each child lived. The list of behaviors selected for counting was

developed after some initial observation. The behaviors included items related to each of the four sections of the Denver Development Screening Test (DDST), e.g. personal-social (playing with other children and adults), fine motor (playing with toys which stimulate fine motor development), gross motor (running, walking), and language development (mother stimulating language development). In addition to items related to these four areas, other behaviors were counted which were considered nurturing or mothering, e.g. mother cuddling, holding the child for feeding, etc. (A complete list of the items can be seen in Appendix 10.)

One of the purposes of the observation was to determine the frequency of nurturing behavior among mothers and caretakers of children in low income families. Several of the behaviors measured which were thought to be particularly indicative of this phenomenon were analyzed in more detail. A Pearson product moment correlation was run on these items, correlating them with length, weight, and growth velocity (length and weight gains).

Table 22 shows significant positive correlations between the frequency with which the index child was observed eating while being held and length and weight. Positive correlations were also observed between the child's being fed and his or her weight and length. A correlation was also noted between the child's eating sitting down (as compared to his eating while running around or standing) and total length gain. Being fed was positively correlated with total weight gain. Behaviors associated with increased activity, e.g. playing with other children, climbing, and playing with toys which stimulate gross motor function, were negatively associated with length, weight, total length increase,

Table 22. Significant Correlations Between the Frequency of Selected Observed Activities and Length, Weight, and Incremental Growth in a Group of Poor Children in San José, Costa Rica (N=44)

Activity	Length 1	Length 2	Length 3	Weight 1	Weight 2	Weight 3
Eating with a spoon	-0.347 ^a (0.021) ^b	-0.317 (0.036)	-0.302 (0.047)	—	—	—
Eating being held	0.395 (0.008)	0.356 (0.017)	0.379 (0.011)	0.314 (0.037)	—	—
Being fed	0.292 (0.011)	—	—	0.376 (0.011)	0.343 (0.022)	0.350 (0.020)
Playing with other children	-0.380 (0.011)	-0.359 (0.017)	-0.370 (0.013)	-0.323 (0.032)	-0.351 (0.020)	-0.426 (0.004)
Activity	Total length gain			Total weight gain		
Eating sitting down	0.363 (0.015)			—		
Being fed	—			0.353 (0.019)		
Climbing	-0.322 (0.033)			—		
Playing with toys which stimulate gross motor function	—			-0.378 (0.011)		

Note: Correlations are derived by use of Pearson product moment statistics.

^ar value.

^bp value, or significance level.

and total weight gain respectively. A negative association was also observed between eating with a spoon and length. The positive correlations associated with being fed, eating while being held, and eating sitting down suggest a pattern in which much more attention is being paid to the child at meal times to ensure that intake is sufficient. The negative correlations suggest that increased activity, such as occurs with climbing and playing with other children, leads to decreased weight gain. All of the children were between the ages of 1 and 3 years of age, which is precisely the time a child usually starts to learn to use a spoon. It is also a time when many become independent about eating and want to feed themselves. The child may eat less because of fatigue or frustration in manipulating the spoon. An adaptive behavior noted with some mothers as a compensation for this learning period was to let the child eat with a spoon while simultaneously feeding him or her, or to feed the child when he or she become tired of eating with the spoon.

In the low weight/length group, the presence of mother cuddling, father cuddling, and continued bottle feeding were all positively associated with length and/or weight (see Table 23). Handwashing was negatively associated with weight. Environmental sanitation conditions were not good in many homes because of the problems with sewage and garbage disposal already mentioned. Usually children were observed to have their hands washed only if they had been outside playing in mud or dirt. Those whose hands were more frequently washed may also have been exposed more frequently to illness-causing organisms. There was probably also an adaptive increase in resistance to these illnesses among children in the poorest environments.

Table 23. Significant Correlations Between the Frequency of Observed Activities and Length and Weight Measurements in the Low Weight/Length Group of Children in San José, Costa Rica

Activity	Length 1	Length 2	Length 3	Length 4	Length 5	Length 6	Length 7
Bottle-feeding	0.492 ^a (0.032) ^b	0.555 (0.014)	0.494 (0.032)	0.480 (0.037)	—	—	—
Mother cuddling	0.597 (0.007)	0.607 (0.006)	0.548 (0.015)	0.613 (0.005)	0.568 (0.011)	0.564 (0.012)	0.537 (0.018)
Activity	Weight 1	Weight 2	Weight 3	Weight 4	Weight 5	Weight 6	Weight 7
Mother cuddling	—	0.468 (0.043)	—	0.557 (0.013)	—	0.464 (0.045)	0.468 (0.043)
Child being restrained	—	—	—	—	-0.481 (0.037)	—	-0.452 (0.052)
Handwashing	—	—	—	—	-0.506 (0.027)	-0.449 (0.053)	-0.523 (0.022)
Father cuddling	—	0.517 (0.023)	0.453 (0.051)	0.465 (0.045)	0.475 (0.040)	0.511 (0.025)	—

Note: Correlations are derived by use of Pearson product moment statistics.

aR value.

bP value, or significance.

The case of Julia illustrates, a case where very little nurturing behavior was noted, no cuddling, feeding, etc., by either the mother or the father or other adults were noted during the time of observation. Julia was 16 months old at the initiation of the observation period and 23 months old at the time of the final measurement. She was included in the low weight/length group. She had a brother who was about 10 months younger than she and who was obviously already favored by the mother. At the final measurement the younger brother out-weighed Julia by about a kilo. Julia's father worked irregularly as a welder. He also worked at odd jobs and seasonal labor when welding was not available. Julia's mother took her to her grandmother's house almost every day. The grandmother lived about three blocks away in a nicer house. Julia usually ate at her grandmother's house. The grandmother, who was very religious and belonged to a fundamentalist cult, spent a great deal of time reading the Bible and praying with friends. At the time of the observation, Julia was pretty much left on her own to eat what she could, which she did standing up at a chair or running around the house. She was also left to play alone and entertain herself most of the time. The mother spent a great deal of time with Julia's brother. Figure 9 shows the growth pattern which was observed for Julia.

Another child in the low weight/length group was called Catia. She was 20 months old at the beginning of the study and 29 months old at the end. Mother cuddling and other nurturing behaviors such as mother feeding were observed. Catia had five brothers and sisters; her father worked as a chauffeur but was out of work sporadically.

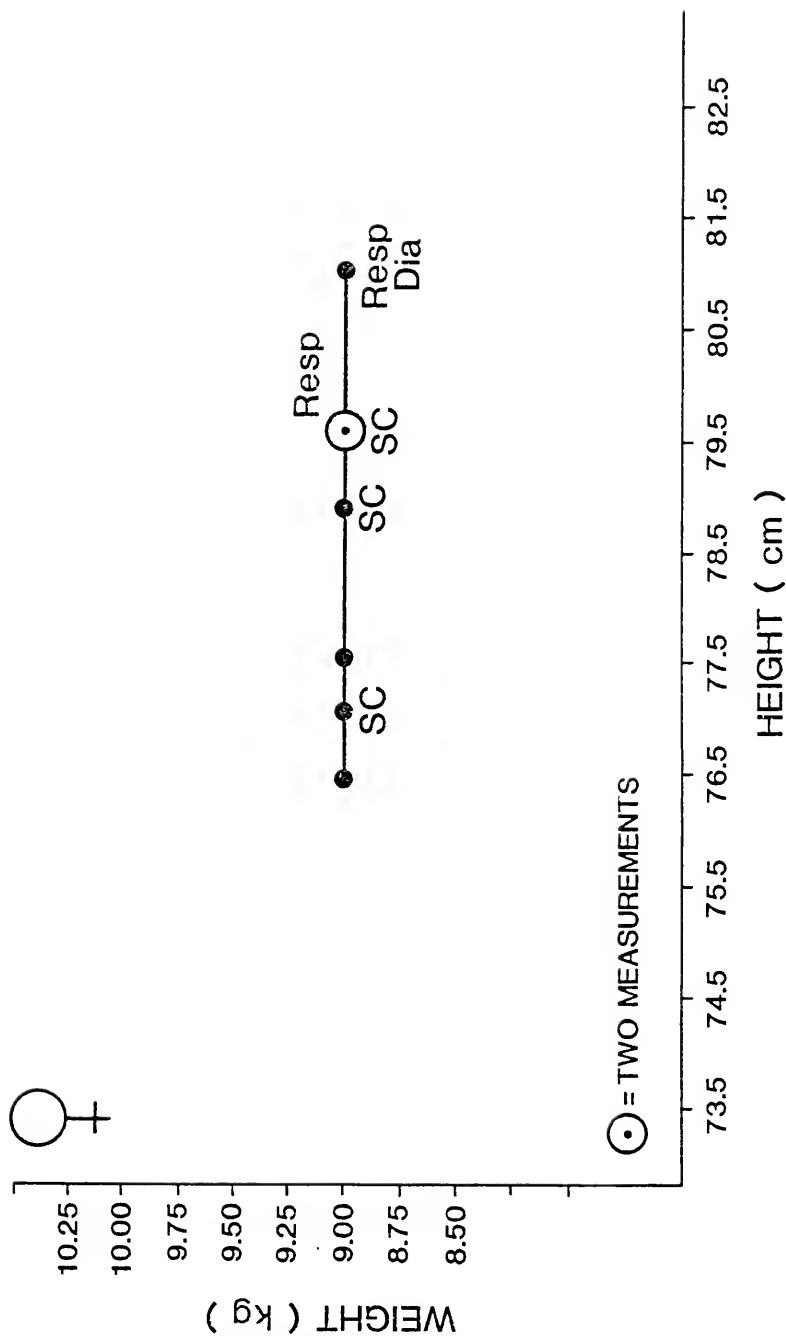


Figure 9. Growth Pattern Exhibited by Julia, Low Weight/Length Group. Dia = Diarrhea] Illness Reported; Resp = Respiratory Illness Reported; SC = Selected Common Symptoms Reported.

Her mother was extremely conscientious about keeping the children clean and fed. The older sisters were encouraged to help with the younger ones. Figure 10 shows the growth pattern observed for Catia. Both children had about the same incidence of illness except that Julia had some diarrhea. I suggest that the extra attention given by the mother and the older sisters and a better diet made the difference in how well Catia thrived in comparison to Julia. The families were very similar in terms of per capita income.

Multivariate Analyses

A multivariate stepwise regression analysis and a stepwise discriminant function analysis were performed to formulate an overall view of the effect of many variables on the nutritional status of the children. An attempt was made to develop a model which could predict a child's nutritional status. The procedure was carried out according to that recommended by Afifi and Azen (1979) and the SAS Institute (1982). The variables analyzed included those concerned with biological characteristics such as birth weight; those having to do with family structure, e.g. sex of the head of the household and the number of children 6 years or age and under; and those related to socioeconomic status such as total income and the amount of money spent on basic food items. Included in the analysis were characteristics of the environment, e.g. number of rooms, number of persons per bed, presence of radios, television, wafflemakers, and blenders, and the frequency with which certain mother/caregiver behaviors were observed during the in-home observation period. The regression analysis included both interval-level variables and nominal variables whereas the discriminate function was performed by use of interval-level variables only.

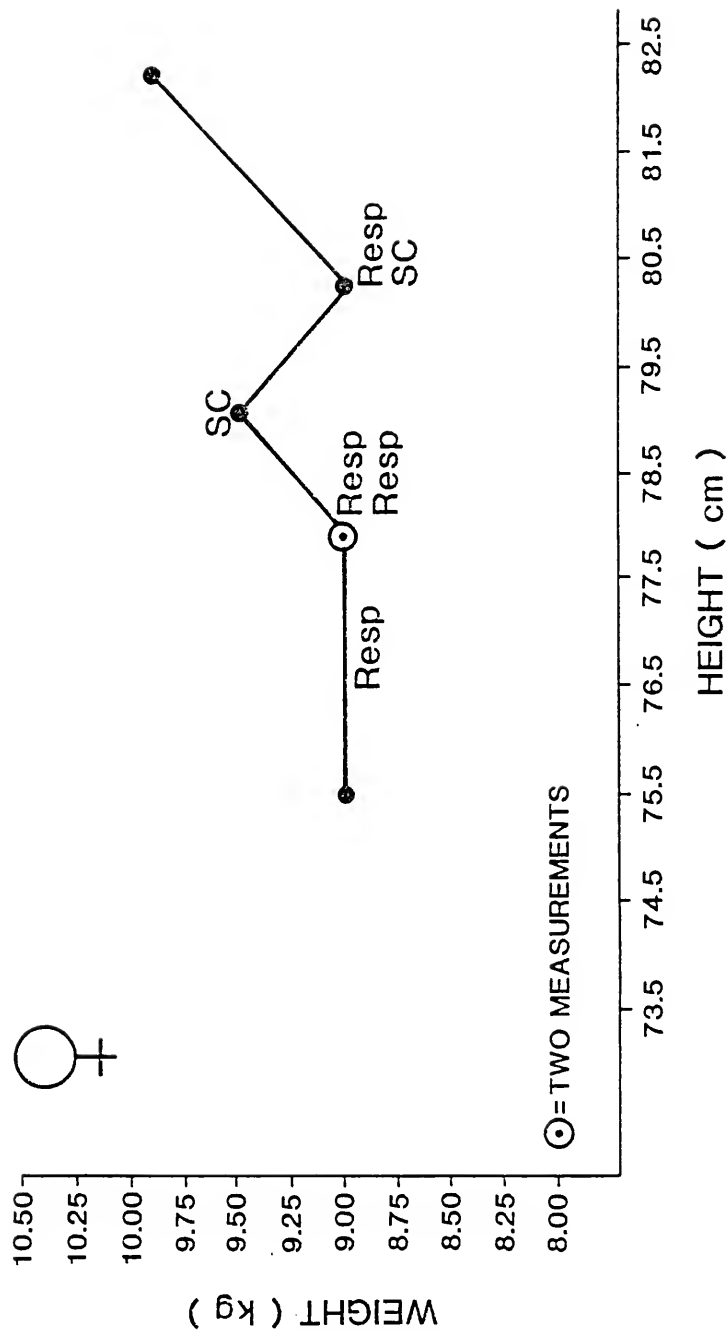


Figure 10. Growth Pattern Exhibited by Catia, Low Weight/Length Group. Resp = Respiratory Illness Reported; SC = Selected Common Symptoms reported.

Stepwise Multivariate Regression

The multivariate regression analysis was run with the weight/length percentile ranking of each child as the dependent variable. Table 24 shows these results. Birth weight, frequency with which a child was observed being fed by the mother or principal caregiver, amount of money spent on dried milk, number of children aged 6 and under, and whether or not the family had a wafflemaker were the five variables which emerged as best for predicting the percentile ranking of each child in the study. The information supplied by these variables explains 47% of the variability between the weight/length percentile rankings of the children in the study population.

Stepwise Discriminant Analysis

A discriminant analysis was performed with low or normal weight/length group membership as the dependent variable. Interval-level variables included the frequency of observed behaviors such as mother cuddling and feeding of the child, monthly cost of certain key food items, number of rooms, number of persons per bed, presence of diarrhea and other illnesses, number of pregnancies, and birth order of the index child. Table 25 shows the results of this analysis.

Birth weight, frequency with which the mother was observed feeding the child, number of children 6 years of age or under, number of persons per bed, and cost of purchasing processed foods (i.e. cooking oil, canned foods, and coffee) emerged as the variables having the most ability to discriminate between children likely to be in the low or normal groups.

Table 24. Stepwise Multiple Regression Procedure for the Dependent Variable Weight/Length Percentile

Variable	B value	F	p
Birth weight	0.01	6.67	0.014
Amount spent on dried milk	0.03	7.24	0.010
Number of children 6 years			
and under	-6.46	4.10	0.050
Wafflemaker	-60.61	11.36	0.002
R square = 0.42.			
Birth weight	0.01	9.10	0.005
Child being fed	-10.13	3.53	0.068
Amount spent on dried milk	0.03	6.41	0.016
Number of children 6 years			
and under	-5.84	3.53	0.068
Wafflemaker	-65.83	10.71	0.002
R square = 0.47.			

Note: Procedure performed with the Statistical Analysis System (SAS Institute 1982).

Table 25. Stepwise Discriminant Analysis for the Dependent Variable Weight/Length Group

Variable	Partial correlation	F	p	Wilks' ^a lambda	p lambda
Birth weight	0.12	5.94	0.019	0.88	0.019
Child being fed	0.10	4.62	0.037	0.79	0.007
Number of children 6 years and under	0.08	3.65	0.063	0.72	0.004
Number of persons per bed	0.17	7.94	0.007	0.60	0.001
Amount spent on processed food	0.06	2.34	0.134	0.56	0.001

Note: Procedures were performed with the Statistical Analysis System (SAS Institute 1982).

^aAn explanation of this procedure is found in the SAS User's Guide: Statistics 1982, p. 11.

To interpret these results the following ethnographic explanation of the variables is provided:

1. In previous studies (cited in Moore, 1978) there was a positive relationship between the total weight gain of the mother during pregnancy and the birth weight of the baby. In the present study, as previously discussed, there was a significant difference in birth weight between the low and normal weight/length groups, with the children in the low weight/length group having lower birth weights.

2. The frequency with which a mother or principal caretaker was observed feeding the index child was one of the behaviors counted during the in-home observation period. As mentioned earlier in Table 22, there was a positive correlation between length, weight, and total weight gain and the frequency with which the mother/caretaker was observed feeding the child. In the multiple regression analysis this variable had a negative relationship to the weight/length percentile ranking, suggesting that more frequent feeding of the child by the mother, rather than allowing self-feeding exclusively, was an adaptive strategy used by mothers who realized their children were underweight. Such families also may have had few resources at their disposal, thus necessitating the reduction of possible waste which may occur in greater amounts with self-feeding. Thus feeding of the child by the mother was observed more often among families of children in the low weight/length group, making it a discriminating factor predicting membership in that group. It also had an overall positive effect on growth, as shown by other measurements.

3. The amount of money spent on dried milk was a measure of food budget management related to the diet of the index child.

Ethnographic data revealed that milk, particularly dried milk, was purchased almost exclusively for children, as were eggs. Thus, this variable can be considered a measure of the orientation toward the dietary needs of the child. In the present study it had a positive relationship to the weight/length percentile ranking. There was also a positive correlation between the amount of money spent on dried milk and that spent on eggs ($r=0.31$, $p\leq 0.04$).

4. The number of children aged 6 years and under appeared in both analyses and had a negative relationship to the weight/length percentile ranking.

5. The presence or absence of a wafflemaker was one of the nominal variables related to material standard of living. Items such as a stereo, television, radio, or blender were too common for their presence to serve as a discriminating variable. However, the presence of a wafflemaker is thought to be a more discriminating measure of economic status than is total household income.

6. The number of persons per bed also proved to be a more discriminating measure of economic status than total household income because it reflects the density of the household population.

7. The amount of money spent each month on processed food is considered to be a measure of both economic status and ability to manage the food budget.

CHAPTER VI DISCUSSION AND CONCLUSIONS

In an effort to understand some of the underlying causes of undernutrition in Costa Rica, this study has focused on an in-depth investigation of individual children in the context of the household. A model of factors leading to undernutrition developed from prior research carried out in rural areas of Costa Rica (Rawson 1975; Rawson and Valverde 1976) was presented in Chapter II as a possible explanation of the etiology of undernutrition in the urban context (see Figure 2).

The small number of children falling below the 5th percentile in the random sample of 107 children born in 1980, which was selected, indicated that the excellent program of health maintenance and nutritional surveillance operating in Costa Rica identified most children who were severely undernourished, as well as most children at risk for mild undernutrition. These children were being referred to the appropriate programs according to their needs, e.g. Tres Rios for the treatment of severely undernourished children, and a community meal site and/or free milk from the health center for children who had become slightly undernourished. High immunization rates of over 90% indicated a successful program of primary health care intervention with regard to children.

Socioeconomic Factors

With respect to occupational and economic factors, the model was found to be particularly inadequate in accounting for strategies employed by female-headed households to enable the families to adequately carry out child-rearing activities. The model presented the mother's working outside the home as a high risk factor for malnutrition of her child (Rawson and Valverde 1976). The data gathered in this study, however, indicated that families where this was more likely to occur were usually in female-headed households. In fact, 73% of the female-headed households had children in the normal weight/length group. What actually happens is that, when a mother works outside the home, caretaking duties are assumed by another female relative, usually an aunt or the grandmother of the child. This situation appears to be a particular characteristic of the extended matrifocal family described as the "Queen Bee," or "Grandmother," family in Chapters I and IV (López de Piza 1979; R. T. Smith 1956), but also sometimes exists in the male-headed extended family. Thus, it would appear that, in contrast to the findings of Rawson and Valverde (1976) in San Ramón, the family organization and structure setup to care for children is more important than whether or not the mother works outside the home. The data appear to indicate that nuclear families may be more at risk for having low weight/length children (54% of these families had children in the normal weight/length group). In fact, as noted earlier, more mothers of low weight/length children than of normal weight/length children did not work outside the home. Formal marriage was more prevalent among parents of children in the low weight/length group, although the majority of the parents of both groups were married.

These figures suggest that a nontraditional family structure which may be rather fluid in nature—expanding in times of need when resources may need to be pooled and decreasing in times of economic well-being—is an effective adaptation that many poor families make which directly contributes to the maintenance of a good nutritional status among dependent children. This family structure includes the kinship support networks in which most families are involved. Contrary to the findings of True (1976:77), alcoholism was not found to be a major problem among the families followed. In several cases, however, alcoholism was responsible for the split-up of spouses which resulted in the formation of matrifocal, extended families.

More of the fathers of children in the low weight/length group worked seasonally or occasionally or were unemployed. Whether the father had a regular job seemed to be of more importance than the kind of occupation. The problem is, however, that unskilled workers are more likely to occupy temporary or seasonal jobs. This fact does not contradict Rawson and Valverde's (1976) finding that whether the father was self-employed or a day laborer was significantly associated with nutritional status.

Ownership of the home was not as important as it had been thought to be. More of the families of normal weight/length children rented or borrowed homes. Fewer actually owned or were buying their homes (36% as compared to 53% among the families of low-weight/length children). In fact, what seems to have happened is that many families of the normal weight/length children continued to live in extremely low rent districts, when they probably could have afforded better housing,

simply because they preferred to use the money saved to eat better or to educate their children.

As inflation increasingly affected Costa Rica's economy, however, those families who had bought houses earlier were beginning to have a great advantage because their payments had not increased with inflation whereas rents had. At the time of the study some families had ridiculously low payments, but others could not afford to acquire their own homes. Thus, ownership of the home may become a more important factor in the future.

Although total household income was lower among families of children in the low weight/length group, the difference was not significant. Families of normal weight/length children spent less on food and had twice as much money left over after food costs were deducted than did families of low weight/length children. It should be noted here that the concept of "real income" originally used in the model was discarded in favor of total income, which includes the combined incomes of all household members plus gifts, allowances, and other payments.

The data indicate that, in general, except for sewing machines and refrigerators, the families of low weight/length children tended to possess more material goods such as stereos, tape recorders, and blenders. Thus, an orientation toward upward mobility, involving the acquisition of material goods to obtain status, may have been more prevalent among families of low weight/length children.

The preceding data also suggest that the crucial socioeconomic factor differentiating the families of low weight/length children from

families of normal weight/length children is management. Knowing where and how to obtain the best buys on food and housing are important factors. Decision making which leads to the purchase of a refrigerator or sewing machine rather than a stereo or television may contribute to family nutrition and income and was part of the home management skills exhibited by mothers of children in the normal weight/length group. These kinds of decisions appeared to enhance the ability of the families to provide adequate nutrition for their children.

Dietary Factors

The condition of the environment proved to be of little importance in distinguishing the low weight/length children from the normal weight/length children. Diet, as assessed by household food frequency data, was also by and large insignificantly differentiating. Further diet analyses based on the division of foods into groups, such as that done by Abramson et al. (1963), and further analyses of 24-hour recall data gathered for each child might indicate some differences. Those analyses, however, will be undertaken elsewhere.

Duration of breast-feeding, age at which bottle feeding was introduced, and age at which regular foods were introduced did not differ significantly between the two groups. There was, however, a tendency toward a longer duration of breast-feeding and a later introduction of bottle feeding and regular foods in the low weight/length group. These data do not dispute the value of breast feeding per se but rather may raise some questions about the quality of extended breast-feeding without the introduction of supplementary foods as needed.

Conceptual Model Describing Children at Nutritional Risk
in the Urban Area

A multivariate regression analysis and a discriminant function analysis were performed, as mentioned in Chapter V. A conceptual model was developed based on these analyses. This model, I believe, more accurately describes the processes which result in low weight/length children in the urban sector than does the original adapted model proposed at the beginning of the study (see Chapter II). The conceptual model (illustrated in Figure 11 in detail) suggests that low birth weight, primarily resulting from maternal undernutrition, is related to mild undernutrition of children in Costa Rica. The subsequent prognosis for these children is determined primarily by maternal competence and management ability, coupled with aspects of family structure such as the number of children 6 years of age and under in the family.

An analysis of variance described earlier revealed that children, particularly boys, in the low weight/length group had birth weights significantly lower than those in the normal weight/length group. According to Mata (1978a), Ounsted et al. (1982), and Villar et al. (1982), children of low birth weight tend to remain in the growth pattern defined by birth characteristics, a finding which supports the model suggested. The earlier work of Rawson and Valverde (1976) in Costa Rica does not mention birth weight. Because there was no significant difference between the height and weight of mothers of children in the low weight/length group and the height and weight of mothers of children in the normal weight/length group, the chance that the lower birth weight is purely genetic in origin is greatly diminished.

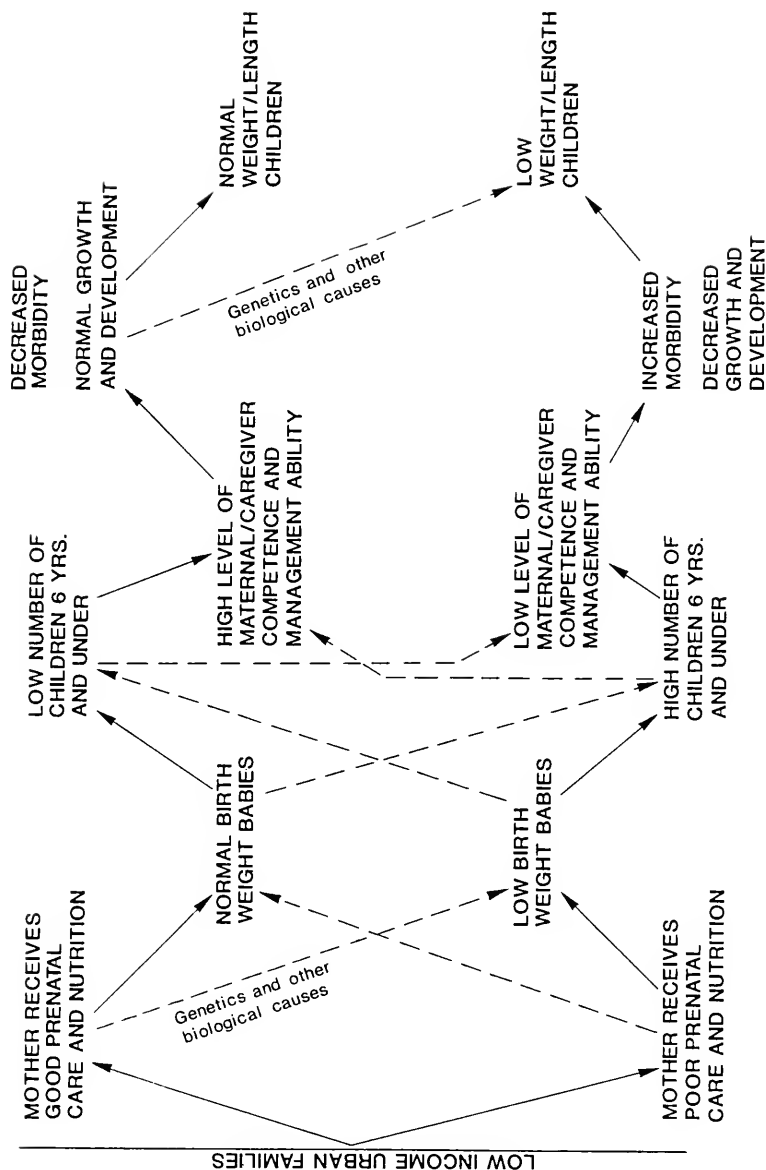


Figure 11. Conceptual Model of Factors Leading to Low or Normal Weight/Length, Low Income Urban Children Under 3 Years of Age.

The conceptual model is suggested as being more appropriate than previous models, which were oriented to factors found to be important to child nutrition in rural areas. Whereas the rural model tends to concentrate on the importance of resources such as "bush foods" and home gardens, for the urban mother equivalent resources may be how well she learns to utilize the health and welfare services available, including aid through the Family Aid Program, and how well she learns to plan meals and buy food. The data on food-purchasing patterns mentioned earlier in Chapter IV, show that there is a tendency for female-headed families, compared to male-headed families, to benefit less from subsidized government food sources. The ability of poor families to take advantage of government subsidized stores was limited in some neighborhoods, such as in Villa Esperanza in Pavas and Copei, because there was no easy access to them or to other large markets offering cheaper prices.

Conclusions

Traditionally, factors such as women working outside the home, female-headed households, and so-called family instability (Beghin et al. 1979; Popkin 1980; Uyanga 1980) have been considered detrimental to the nutritional status of children. My data, however, suggest that an across-the-board condemnation of nontraditional family structure as pathological is not rational given the effective survival strategies demonstrated by the matrifocal extended family, including its apparent ability to expand and contract according to economic needs.

The data gathered in this study suggest that mild undernutrition among children in Costa Rica, given governmental intervention programs, results primarily from low weight at birth and from subsequent deficiencies in maternal competence and management. This finding raises questions about the general orientation of existing nutrition intervention programs. It may be that the problem would be better dealt with if more attention were placed on what I shall call the "maternal factor." This factor includes biological aspects, such as prenatal nutrition and overall maternal health, and sociocultural aspects, such as maternal competence, or what Mata (1980) has called "maternal technology." Maternal competence includes managing abilities such as knowledge of how to shop and make rational decisions about what foods and other necessities are most economical and beneficial. It was noted, for example, that many mothers of children in the low weight/length group tended to buy expensive processed foods such as luncheon meat, potato chips, and cookies rather than taking the time to cook rice and beans and other more nutritious foods. Factors probably contributing to this tendency are television and radio advertising, the availability of processed foods, and increases in the cost of electricity and other fuels used in cooking.

Buying patterns are also important. Some families were well organized in their buying habits, regularly buying staples as soon as they received their wages and before the money could be spent on other items. Other families were more disorganized in their buying habits, tending to buy when they ran out of food even though they had access to a regular paycheck. Still other families had no regular

income and of course had to buy when they had money. Most of the families of children in the low weight/length group did have regular paychecks coming in (12, or 63%); however, most were not well organized in their buying habits.

Another area of maternal competence has to do with nurturing, or mothering behavior. Mother cuddling, feeding the child, and other types of nurturing behavior were found to be positively correlated with height, weight, and growth, particularly among children in the low weight/length group. This relationship would probably be more pronounced if behaviors related to nurturing had been followed in more detail. I suggest that, although passing on mothering skills has in the past been part of the enculturation process for girls, today's changing society has tended to disrupt this process. Women's roles are changing in all countries as more and more women enter the formal working world of industry. With mothers spending less time with their children, mothering skills are less likely to be passed on informally and may even be viewed in a negative light; witness attitudes toward breast-feeding. Thus, the task of teaching women to be mothers or how to parent may fall to the schools and/or the institutions involved in health maintenance. Because social change has been so rapid, in many cases the skills a mother learned may seem irrelevant to her daughter. Certainly the project begun in the Puriscal area of Costa Rica by the National Institute for Health Research (INISA) (Mata et al 1981) to encourage maternal-infant bonding, i.e. a strong attachment of the mother to her child (Claus and Kennel 1976), and to promote breast-feeding is a step in the right direction. It may be

necessary, however, to carry this intervention further, including the teaching of home management and child-rearing techniques applicable to toddlers as well as infants. The Puriscal program at present seems to be more oriented toward nonworking mothers. Because of the importance that family structure seems to have in child rearing, however, it is important to recognize other potential caregivers in the family and to include them in whatever educational efforts are made. The training of mothers in home health care techniques, such as the care of children with diarrhea by use of oral rehydration and good hygiene, is one possibility. Another might be teaching mothers how to use growth charts to keep track of their children's growth. I found mothers to be very interested in monitoring the growth and development of their children.

Women also need to be taught more about their own health. It is quite possible for a woman who is competent in the care of her children to fail to take care of herself adequately during pregnancy. Thus, mothers who are intelligent enough to be competent managers of their children's health and nutrition should be able to apply to themselves similar skills if they understand the need for doing so. Certainly most health and nutrition programs tend to ignore the tremendous potential resource represented by a well-informed mother.

The in-home observation done as part of this study was merely a beginning and should be followed by a more in-depth, long-term evaluation of the home environment and maternal behaviors related to child growth and development (including intellectual stimulation). Behaviors

specifically related to the transmission of such illnesses as diarrhea and respiratory problems were not the main focus; they also should be studied because they represent an area in which maternal competence is a key factor in any preventive efforts.

In summary, the data raise questions about the importance of maternal input in a variety of areas and how it relates to the nutritional status of the child in urban Costa Rica. The size of the sample population, necessary because of the in-depth nature of the data collection, precludes sweeping conclusions. The data do, however, suggest the following directions in which future research and intervention could be directed.

1. More detailed study of the etiology of low birth weight babies and the development of preventive measures, including sociocultural as well as biological measures.

2. Additional study of child-rearing and maternal-nurturing behaviors in both urban and rural areas to develop adequate ways of evaluating maternal coping behaviors, especially as they are affected by rapid social change.

3. Further evaluation of the geographical placement of government subsidized food outlets in terms of their accessibility to low income families, especially female-headed, low income families.

In terms of nutrition intervention programs, the data suggest that in future planning in Costa Rica more emphasis should be placed on the maternal factor. Good prenatal care (especially adequate nutrition) and education of mothers in mothering skills, home management, and care of their own health are important aspects of this factor, and

appear to be necessary complements to existing programs in the elimination of chronic mild undernutrition in low income urban children.

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APPENDIX 1
FAMILY REGISTRY

APPENDIX 2
MEDICAL HISTORY OF THE INDEX CHILD

HISTORIA MEDICA DEL NIÑO (Niño Índice—Primera Visita)

1. Código Individual _____

2. Fecha _____

3. Sexo (1) M (2) F

4. Edad (meses) _____

VACUNACIÓN

5. BCG (1) básico-completo (2) básico-incompleto
(3) completo-refuerzo (4) sin ningun vacunación
(5) otro _____

6. DPT (1) básico-completo (2) básico-incompleto
(3) completo-refuerzo (4) sin ningun vacunación
(5) otro _____

7. Polio (1) básico-completo (2) básico-incompleto
(3) completo-refuerzo (4) sin ningun vacunación
(5) otro _____

8. Sarampión (1) básico-completo (2) básico-incompleto
(3) completo-refuerzo (4) sin ningun vacunación
(5) otro _____

9. Sarampión-rubeola (1) básico-completo (2) básico-incompleto
(3) completo-refuerzo (4) sin ningun vacunación
(5) otro _____

ENFERMEDADES DURANTE EL ULTIMO AÑO

10. Diarrea (1) si (2) no Cuantas veces _____

11. Vomitos (1) si (2) no " " _____

12. Parásitos (1) si (2) no " "

13. Fiebre (1) si (2) no " "

14. Tos (1) si (2) no " "

- | | | | |
|--|--|---------------|-------|
| 15. Gripe | (1) si (2) no | Cuantas veces | _____ |
| 16. Resfrio | (1) si (2) no | " " | _____ |
| 17. Alergia | (1) si (2) no | " " | _____ |
| 18. Falta de apetito | (1) si (2) no | " " | _____ |
| 19. Dermatitis-granos | (1) si (2) no | " " | _____ |
| 20. Sarampión | (1) si (2) no | " " | _____ |
| 21. Rubeola | (1) si (2) no | " " | _____ |
| 22. Paperas | (1) si (2) no | " " | _____ |
| 23. Varicela | (1) si (2) no | " " | _____ |
| 24. Estomatitis | (1) si (2) no | " " | _____ |
| 25. Hepatitis viral | (1) si (2) no | " " | _____ |
| 26. Heridas accidentales | (1) si (2) no | " " | _____ |
| 27. Otras | _____ | | |
| 28. Hospitalizaciones | (1) si (2) no | | |
| 29. Quién cuida el niño cuando esta enfermo? | (1) madre (2) padre | | |
| | (3) abuela (4) hermana or hermano mayor (5) tia (6) china (empleada) | | |
| | 7) amigas-amigos (8) otro | _____ | |
| 30. Establecimiento donde se controla | (1) centro de salud (2) hospital | | |
| | (3) CCSS (4) médico particular (5) clinica privada (6) sin control | | |
| | (7) otro | _____ | |

Observaciones:

APPENDIX 3
HISTORY OF MATERNAL LACTATION

HISTORIA DE LACTANCIA MATERNA
(Niño Índice)

1. Código individual _____
2. Edad (meses) _____
3. Cuanto tiempo fué amamantado? (1) continúa amamantando (2) menos de un mes (3) 1-3 meses (4) 4-6 meses (5) 7 meses a un año (6) no le dió (7) mas que un año (8) otro _____
4. A que edad le dió el primer chupón de leche? (1) menos de un mes (2) 1-3 meses (3) 4-6 meses (4) 7 meses a un año (5) mas que un año (6) otro _____
5. Porque se dejó de amamantar al niño? _____

6. A que edad le empezó a dar comida? (1) menos de un mes (2) 1-3 meses (3) 4-6 meses (4) 7 meses a un año (5) mas que un año (6) otro _____
7. Que tipo de alimentos le da al niño? _____

8. Quién prepara la comida del chiquito? (1) madre (2) padre (3) abuela (4) hermana o hermano mayor (5) tia (6) china o empleada (7) otro _____

Observaciones:

APPENDIX 4
CONDITION OF HOUSING AND ENVIRONMENT

CONDICIÓN DE LA VIVIENDA

1. Código familiar _____
2. Construcción de paredes (1) ladrillo o block (2) madera (3) bahareque (4) zinc (5) baras o palma (6) deshechos (7) otro _____
3. Condiciones de las paredes (1) buena condición (2) pintura mala (3) huecos en las paredes (4) sucias (5) 2 y 3 (6) 2 y 4 (7) 3 y 4 (8) 2, 3, y 4 (9) otro _____
4. Construcción de pisos (1) cemento (2) madera (3) tierra (4) otro _____
5. Condición de pisos (1) bueno--limpio (2) bueno--sucio (3) regular--limpio (4) regular--sucio (5) malo--limpio (6) malo--sucio (7) otro _____
6. Construcción del techo (1) teja (2) zinc (3) abastecimiento (4) palma (5) deshecho (6) otro _____
7. Condición del techo (1) bueno (2) malo (tiene huecos) (3) otro _____
8. Ventilación (1) buena (2) mala (3) otro _____
9. Número de cuartos (1) 1 (2) 2 (3) 3 (4) 4 (5) 5 o mas (6) otro _____
10. Número de camas (1) 1 (2) 2 (3) 3 (4) 4 (5) 5 (6) 6 or mas (7) otro _____
11. Número de personas por cama _____

12. Duerman en el suelo? (1) si (2) no (3) otra _____
13. Tipo de cocina (1) gas (2) leña-carbón (3) canfín (4) electricidad
14. Condición de la cocina (1) buena (2) regular (3) malo (4) otro _____
15. Tipo de alumbrado (1) electricidad (2) lámpara de canfín (3) vela (4) otra _____
16. Eliminación de excretas (1) alcantarillado (2) tanque séptico (3) letrina sanitaria (4) pozo de absorción (5) desagüe corriente de agua (6) campo (7) otro _____
17. Condición de eliminación de excretas (1) individual--bueno y limpio (2) individual--bueno y sucio (3) individual--malo y limpio (4) individual--malo y sucio (5) colectivo--bueno y limpio (6) colectivo--bueno y sucio (7) colectivo--malo y limpio (8) colectivo--malo y sucio (9) otro _____
18. Baño (1) individual (2) colectivo (3) no hay (4) otra _____
19. Abastecimiento de agua (1) cañería (2) fuente público (3) pozo (4) bomba (5) lluvia (6) río o quebrada (7) otro _____
20. condición de abastecimiento de agua (1) bueno (2) regular (3) mala
21. Animales domésticos permitidos (1) si (2) no
22. Animales domésticos no permitidos (1) vacas (2) chanchos (3) caballos (4) pollos (más que 4) (5) cabras (6) otro _____
23. Radio (1) si (2) no
24. Televisión (1) si (2) no
25. Equipo de sonido (1) si (2) no
26. Refrigeradora (1) si (2) no
27. Licuadora (1) si (2) no

- 28. Grabadora (1) si (2) no
- 29. Máquina de coser (1) si (2) no
- 30. Percolador (1) si (2) no
- 31. Toastador de pan (1) si (2) no
- 32. Waflera (1) se (2) no

APPENDIX 5
ANTHROPOMETRIC MEASUREMENTS

MEDIDAS ANTROPOMETRICAS

1. Código individual _____
2. Sexo (1) M (2) F
3. Fecha de nacimiento
4. Edad (meses) _____

Medida									
Fecha									
Peso									
Talla									
Perímetro cefálico									
Perímetro brazo									
Pliegue cutáneo tricipital									
Pliegue subescapular									
Categoría Gómez									
Peso-talla									
Talla-edad									

APPENDIX 6
SYMPTOMS OF MALNUTRITION

SINTOMAS DE MALNUTRICIÓN
(Niño Índice)

1. Código individual _____

COMPORTAMIENTO

- | | | |
|-------------|--------|--------|
| 2. Apatía | (1) si | (2) no |
| 3. Iritable | (1) si | (2) no |
| 4. Alerta | (1) si | (2) no |
| 5. Letargo | (1) si | (2) no |

PELO

- | | | |
|----------------------------|--------|--------|
| 6. Seco | (1) si | (2) no |
| 7. Quebradizo | (1) si | (2) no |
| 8. Escaso o ralo | (1) si | (2) no |
| 9. Se desprende facilmente | (1) si | (2) no |

OJOS

- | | | |
|---------------------------|--------|--------|
| 10. Conjuntivitis sin pus | (1) si | (2) no |
| 11. Mancha de Bitot | (1) si | (2) no |
| 12. Queratomalacia | (1) si | (2) no |
| 13. Xerofalmia | (1) si | (2) no |

BOCA

- | | | |
|-------------------------|--------|--------|
| 14. Estomatitis angular | (1) si | (2) no |
| 15. Caries | (1) si | (2) no |
| 16. Edema de la lengua | (1) si | (2) no |

PIEL

- | | | |
|--------------------------------|--------|--------|
| 17. Ulceras, infección | (1) si | (2) no |
| 18. Seco, escamosa | (1) si | (2) no |
| 19. Signo del trapo humedo | (1) si | (2) no |
| 20. Hiperqueretosis folicular | (1) si | (2) no |
| 21. Despigmentación de la piel | (1) si | (2) no |

OTROS SIGNOS

- | | | |
|----------------------------------|--------|--------|
| 22. Edema de cara y extremidades | (1) si | (2) no |
| 23. Debilidad general | (1) si | (2) no |
| 24. Hipotrofia muscular | (1) si | (2) no |
| 25. Diarrea | (1) si | (2) no |

APPENDIX 7
SOCIOECONOMIC STATUS

ESTATUS SOCIOECONÓMICO

1. Código familiar _____
2. Ocupación padre (calificado) _____
3. Ocupación padre (actual) _____
4. Patrón de empleo (1) asalariado estable (2) trabaja por cuenta propio (3) de vez en cuando (4) desempleado (5) por temporadas (6) otro _____
5. Cuanto gana por mes? _____
6. Ocupación madre (calificado) _____
7. Ocupación madre (actual) _____
8. Patrón de empleo (1) asalariado estable (2) trabaja por cuenta propio (3) de vez en cuando (4) desempleado (5) por temporadas (6) otro _____
9. Cuanto gana por mes? _____
10. Trabaja algunos otros miembros de la familia? (1) si (2) no
11. Quiénes y cuanto ganan? _____

12. Otras entradas (IMAS, Asignaciones Familiares, regalos, etc.) _____

13. Ahorros (1) si (2) no Cuanto? _____
14. Compran artículos a largo plazo? (1) si (2) no
15. Cuanto se paga de mensualidad? _____

GASTOS MENSUALES RELACIONADOS A LA VIVIENDA

16. Tenencia de la casa (1) propia (2) amortizada (3) alquilada
(4) prestada (5) otra _____
17. Gastos mensuales de vivienda (alquiler, etc.) _____
18. Gastos mensuales de luz _____
19. Gastos mensuales de agua _____
20. Gastos mensuales de gas _____
21. Gastos mensuales de telefono _____
22. Gastos mensuales municipales (basura, alcantarillado, limpieza, etc.)

23. Otras gastos _____

APPENDIX 8
FOOD BUDGET AND BUYING PATTERNS

PATRONES DE COMPRA Y PRESUPUESTO DE ALIMENTOS

1. Código familiar_____
2. Fecha_____
3. Pan—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces
por semana (3) semanalmente (4) por
quincena (5) por mes (6) nunca (7)
otro_____
4. Pan—donde se compra (1) pulpería (2) supermercado (3)
estanco (4) mercado (5) almacen
(6) carnicería (7) verdulería
(8) pandería (9) otro_____
5. Pan—costo_____
6. Leche (liquido)—frecuencia (1) 1 o mas veces diaria (2) 2-3 veces
de compra por semana (3) semanalmente (4) por
quincena (5) pro mes (6) nunca
(7) otro_____
7. Leche (liquido)—donde (1) pulpería (2) supermercado
se compra (3) estanco (4) mercado (5) almacen
(6) carnicería (7) verdulería
(8) lechero (9) otro_____
8. Leche (liquido)—costo_____
9. Leche en polvo—frecuencia (1) 1 o mas veces diaria (2) 2-3 veces
por semana (3) semanalmente (4) por
quincena (5) por mes (6) nunca (7)
otro_____
10. Leche en polvo—donde (1) pulpería (2) supermercado (3)
se compra estanco (4) mercado (5) almacen
(6) carnicería (7) verdulería
(8) otro_____
11. Leche en polvo—costo_____

12. Huevos—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____
13. Huevos—donde se compra (1) pulperia (2) supermercado (3) estanco (4) mercado (5) almacen (6) carniceria (7) verduleria (8) otro _____
14. Huevos—costo _____
15. Verduras—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____
16. Verduras—donde se compra (1) pulperia (2) supermercado (3) estanco (4) mercado (5) almacen (6) carniceria (7) verduleria (8) Feria del agricultor (9) otro _____
17. Verduras—costo _____
18. Frutas—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____
19. Frutas—donde se compra (1) pulperia (2) supermercado (3) estanco (4) mercado (5) almacen (6) carniceria (7) verduleria (8) Feria del agricultor (9) otro _____
20. Frutas—costo _____
21. Arroz—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____
22. Arroz—donde se compra (1) pulperia (2) supermercado (3) estanco (4) mercado (5) almacen (6) carniceria (7) verduleria (8) otro _____
23. Arros—costo _____
24. Carne de res—frecuencia de compra (1) 1 or mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____

37. Maíz—costo _____
38. Frijoles—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____
39. Frijoles—donde se compra (1) pulpería (2) supermercado (3) estanco (4) mercado (5) almacen (6) carnicería (7) verdulería (8) Feria del agricultor (9) otro _____
40. Frijoles—costo _____
41. Alimentos procesados (azúcar, café, aceite, etc.)—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____
42. Alimentos procesados—donde se compra (1) pulpería (2) supermercado (3) estanco (4) mercado (5) almacen (6) carnicería (7) verdulería (8) otra _____
43. Alimentos procesados—costo _____
44. Licor—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____
45. Licor—donde se compra (1) bar (2) cantina (3) deposito de licores (4) supermercado (5) almacen (6) pulpería (7) otro _____
46. Licor—costo _____
47. Quién compra los alimentos por lo general? (1) madre (2) padre (3) abuela (4) abuelo (5) hermana (6) hermano (7) hijo, hija (8) otra _____
48. Como se pagan los alimentos (1) al contado (2) fiado (3) otro _____
49. Costo total de alimentos durante la semana _____

25. Carne de res—donde se compra (1) pulpería (2) supermercado (3) estanco (4) mercado (5) almacén (6) carnicería (7) verdulería (8) otro _____
26. Carne de res—costo _____
27. Cerdo—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____
28. Cerdo—donde se compra (1) pulpería (2) supermercado (3) estanco (4) mercado (5) almacén (6) carnicería (7) verdulería (8) otro _____
29. Cerdo—costo _____
30. Pollo—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____
31. Pollo—donde se compra (1) pulpería (2) supermercado (3) estanco (4) mercado (5) almacén (6) carnicería (7) verdulería (8) otro _____
32. Pollo—costo _____
33. Pescado o mariscos—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____
34. Pescado—donde se compra (1) pulpería (2) supermercado (3) estanco (4) mercado (5) almacén (6) carnicería (7) verdulería (8) pescadería (9) otro _____
35. Maíz—frecuencia de compra (1) 1 o mas veces diaria (2) 2-3 veces por semana (3) semanalmente (4) por quincena (5) por mes (6) nunca (7) otro _____
36. Maíz—donde se compra (1) pulpería (2) supermercado (3) estanco (4) mercado (5) almacén (6) carnicería (7) verdulería (8) otro _____

APPENDIX 9
REPRODUCTIVE HISTORY OF MOTHER

1. Código individual _____
2. Fecha de nacimiento _____
3. Edad _____
4. Numero de embarazos _____

[illegible]

APPENDIX 10
OBSERVATION OF INDEX CHILD'S BEHAVIOR

Individual code _____ Date _____

Observations (3 min/15 min)

Activity

	1	2	3	4	5	6	7	8	9	10	11	12
Time												
1. Nursing												
2. Bottle												
3. Eating with hands												
4. Eating with spoon												
5. Eating standing												
6. Eating sitting												
7. Eating being held												
8. Snacking												
9. Being fed												
10. Playing by self												
11. Playing with toys—FM												
12. Playing with toys—GM												

Activity

Observations (3 min/15 min)

	1	2	3	4	5	6	7	8	9	10	11	12
Time												
40. Climbing												
41. Drinking—glass												
42. Father kissing/cuddling												
43. Fighting												

APPENDIX 11
SELECTED FOODS THOUGHT TO BE APPROPRIATE AND INAPPROPRIATE FOR
THE INDEX CHILD AMONG LOW INCOME FAMILIES
IN SAN JOSÉ, COSTA RICA

Food	Low weight/ length (N=19)	Appropriate weight/length (N=25)
	----- % -----	
Green mango		
Appropriate	79	56
Inappropriate	16	20
Don't know	5	24
Ripe plantain		
A	100	100
I	—	—
DK	—	—
Pineapple		
A	84	84
I	11	12
DK	5	4
<u>Guineo verde</u> (green banana)		
A	95	100
I	5	—
DK	—	—
Tangerine		
A	84	96
I	5	—
DK	11	4
<u>Tapa dulce</u> (brown cane sugar)		
A	74	76
I	16	20
DK	10	4
Sweet lemon		
A	100	96
I	—	—
DK	—	4
Yam		
A	95	96
I	—	—
DK	5	4

Food	Low weight/ length (N=19)	Appropriate weight/length (N=25)
	%	
Tubers (manioc, etc.)		
A	100	100
I	—	—
DK	—	—
Watercress		
A	95	68
I	5	24
DK	—	8
Papaya		
A	95	100
I	—	—
DK	5	—
Liver		
A	100	100
I	—	—
DK	—	—
Sausage		
A	89	68
I	—	8
DK	11	24
Chicken		
A	100	100
I	—	—
DK	—	—
Milk		
A	100	100
I	—	—
DK	—	—
Tomato		
A	100	88
I	—	8
DK	—	4
Lettuce salad		
A	95	80
I	—	12
DK	5	8
Hamburger		
A	100	92
I	—	8
DK	—	—
Lunchmeat		
A	100	68
I	—	16
DK	—	16

Food	Low weight/ length (N=19)	Appropriate weight/length (N=25)
	----- % -----	
Cake		
A	89	72
I	—	12
DK	11	16
Green beans		
A	84	88
I	5	8
DK	11	4
Strawberries		
A	79	76
I	—	4
DK	21	20
Cookies		
A	84	92
I	5	4
DK	11	4
Spaghetti		
A	100	96
I	—	—
DK	—	4
Ato1		
A	100	96
I	—	4
DK	—	—
Peas		
A	84	60
I	5	12
DL	11	28
Tortilla		
A	90	88
I	5	12
DK	5	—
Coffee*		
A	26	32
I	42	36
DK	32	32
Jello		
A	95	92
I	—	8
DK	5	—
Beans		
A	79	80
I	11	16
DK	10	4

Food	Low weight/ length (N=19)	Appropriate weight/length (N=25)
	----- % -----	
Pork		
A	74	68
I	21	12
DK	5	20
Corn		
A	79	60
I	16	16
DK	5	24
Soda crackers		
A	95	100
I	—	—
DK	5	—
Bread		
A	90	100
I	5	—
DK	—	—
Rice		
A	95	100
I	5	—
DK	—	—
Chocolate		
A	84	72
I	11	12
DK	5	16
Corn flakes		
A	95	76
I	5	16
DK	—	8
Egg		
A	100	100
I	—	—
DK	—	—
Mustard greens		
A	74	68
I	16	16
DK	10	16
Orange juice		
A	100	100
I	—	—
DK	—	—
Liquor*		
A	—	—
I	84	80
DK	16	20

Food	Low weight/ length (N=19)	Appropriate weight/length (N=25)
	----- % -----	-----
Cauliflower		
A	95	72
I	—	12
DK	5	16
Coke*		
A	32	32
I	53	44
DK	16	24
Butter/margarine		
A	89	84
I	11	8
DK	—	8
Potato		
A	100	96
I	—	4
DK	—	--
Orange		
A	100	100
I	—	—
DK	—	—
Squash		
A	84	84
I	5	8
DK	11	8
Soup		
A	100	100
I	—	—
DK	—	—
Watermelon		
A	79	100
I	16	—
DK	5	—
Beer*		
A	—	—
I	79	80
DK	21	20
Gerber cereal		
A	84	100
I	5	—
DK	11	—
Ice cream		
A	79	92
I	11	—
DK	10	8

Food	Low weight/ length (N=19)	Appropriate weight/length (N=25)
	----- % -----	-----
Spinach		
A	100	92
I	—	4
DK	—	4
Banana		
A	100	100
I	—	—
DK	—	—
Cantelope		
A	74	92
I	5	—
DK	21	8
Cabbage salad		
A	79	72
I	11	20
DK	10	8
Carrots		
A	100	100
I	—	—
DK	—	—
White sugar		
A	79	80
I	5	4
DK	16	16
Red beets		
A	95	92
I	5	4
DK	—	4
Pancakes		
A	79	76
I	5	16
DK	16	8
Fish		
A	100	96
I	—	—
DK	—	4
Tuna (canned)		
A	79	60
I	5	16
DK	16	24
Beefsteak		
A	100	96
I	—	4
DK	—	—

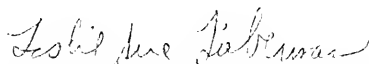
Food	Low weight/ length (N=19)	Appropriate weight/length (N=25)
Vegetable beef stew		
A	100	100
I	—	—
DK	—	—
Potato chips		
A	100	84
I	—	12
DK	—	4
Gerber fruit		
A	74	72
I	16	20
DK	10	8
Sour cream (natilla)		
A	90	84
I	5	8
DK	5	8
Blackberries		
A	84	88
I	5	4
DK	11	8
Marañon (cashew fruit)		
A	74	68
I	—	16
DK	26	16
White cheese		
A	95	92
I	—	4
DK	5	4
Ripe mango		
A	100	96
I	—	—
DK	—	4
Apple		
A	100	92
I	—	8
DK	—	—

*Foods most people considered unsuitable for children.

BIOGRAPHICAL SKETCH

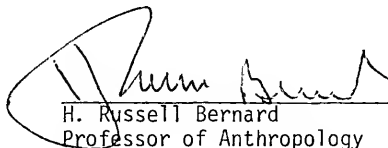
Sharleen Hirschi Simpson, born and reared on a farm in Idaho, was the oldest of eight children. A career in nursing seemed a natural choice. She studied first at Ricks College in Idaho and then at the University of Utah, graduating in 1962 with the degree of Bachelor of Science with a major in nursing. After graduation she entered the Peace Corps during its first year of existence, serving for two years as a nurse in eastern Bolivia. After her Peace Corps experience she obtained the degree of Master of Science with a major in community health nursing at the University of California-San Francisco. She then studied anthropology at the University of Arizona and in 1970 obtained the degree of Master of Arts with a major in anthropology. She has spent about nine years in South and Central America and the Caribbean, living in Paraguay, Chile, Costa Rica, and Puerto Rico, as well as Bolivia. She is fluent in Spanish. She has approximately 15 years of experience in all aspects of nursing. She has two sons, Roderick and Randall, aged 13 and 10, who have also spent considerable time in Latin America. Her hobbies include playing the piano and guitar, singing barbershop harmony, and watercolor painting.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Leslie S. Lieberman, Chairperson
Associate Professor of Anthropology

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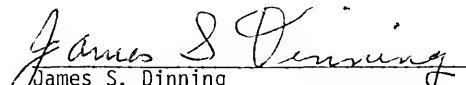
H. Russell Bernard
Professor of Anthropology

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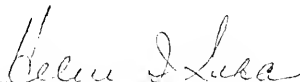
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Professor of Anthropology

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James S. Dinning
Professor of Food Science and Human
Nutrition

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Helen I. Safa
Professor of Latin American Studies

This dissertation was submitted to the Graduate Faculty of the Department of Anthropology in the College of Liberal Arts and Sciences and to the Graduate School, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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